Learning to Leapfrog: Innovative Pedagogies to Transform Education

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David Istance and Alejandro Paniagua

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Authors

David Istance is a nonresident senior fellow at the Brookings Institution and former senior analyst at the Centre for Educational Research and Innovation of the Organisation for Economic Co-operation and Development (OECD).

Alejandro Paniagua is a former elementary school teacher, teacher educator, and associate professor at the University of Barcelona and, until recently, a consultant to the OECD.

TABLE OF CONTENTS

List of Figures

List of Boxes

The Leapfrog Imperative: There Is an Urgent Need for Future-Ready Teaching and Learning

This report follows up on the book "Leapfrogging Inequality: Remaking Education to Help Young People Thrive," published in 2018 by the Center for Universal Education (CUE) at the Brookings Institution. The book argued the importance of education leapfrogging– creating transformative shifts rather than incremental evolution by harnessing the power of innovation to advance a breadth of skills.[1] The book put forth a framework for leapfrogging (figure 1.1) that outlined two core elements (teaching and learning, and recognition of learning) and two support elements (people and places, and technology and data).

This report focuses on the teaching and learning element of the leapfrog framework, especially on pedagogical approaches and the role of teachers, but draws on the others as relevant. It does not attempt to be exhaustive and does not pretend to address neither all education policy variables, nor critical system factors such as political will and adequate funding, nor demand-side factors such as student and parent support for innovative approaches.

We join an international clamor of concern summed up recently as "the learning crisis."[2] For a long time, the main route to improving learning has been perceived to be in widening education access, giving all countries the universal levels of participation enjoyed by the well-resourced systems of the developed world. This remains to be fully achieved, especially for certain sections of the populations that are systematically excluded. However, now that much progress has been achieved globally in extending access, new fundamental questions are being raised. Do children and young people acquire sufficient levels of knowledge and competencies during their years of education, and what do they learn? Are the foundations being laid in the early years, when young people normally attend

The Leapfrog Pathway

CORE ELEMENTS
Teaching and Learning: Increasingly Student-Centered

TEACHING	POTENTIAL TO LEAPFROG	LEARNING
Playful + Interactive + Lecture-based	LEAP	**Evaluate and Create +** Apply and Analyze + Remember and Understand
Interactive + Lecture-based	SKIP	**Apply and Analyze** + Remember and Understand
Lecture-based	HOP	Remember and Understand

Recognition of Learning: Increasingly Individualized

PROGRESSION	POTENTIAL TO LEAPFROG	VERIFICATION
Individual-based + Group-based + Predetermined	LEAP	**Industry-led** + Hybrid-led + Education-led
Group-based + Predetermined	SKIP	**Hybrid-led** + Education-led
Predetermined	HOP	Education-led

SUPPORT ELEMENTS
People and Places: Increasingly Diverse

PEOPLE	POTENTIAL TO LEAPFROG	PLACES
Everyone + Teachers team with others + Licensed teachers	LEAP	**In a diversity of contexts** + Connected to outside school + In-school
Teachers team with others + Licensed teachers	SKIP	**Connected to outside school** + In-school
Licensed teachers	HOP	In-school

Technology and Data: Increasingly Results Oriented

TECHNOLOGY	POTENTIAL TO LEAPFROG	DATA
Modification and redefinition + Augmentation + Substitution	LEAP	**Data for transforming learning experiences** + Data for program improvement + Data for compliance
Augmentation + Substitution	SKIP	**Data for program improvement** + Data for compliancel
Substitution	HOP	Data for compliance

school, on which to base lifetimes of further learning? A leapfrogging through learning transformation is required to address the gravity of the current crisis.

The Aims of This Report

The overall goal of this report is to deepen insights on how to leapfrog. Specifically, this report focuses on what might be done to address the learning crisis and to transform education systems to meet the demands of tomorrow. The report's value-added is its sharp pedagogical focus and its twin themes:

- **Pedagogical innovation is critical and is at the heart of the ambition to leapfrog education systems.** This is especially true for learning by children and young people, but also true for learning by teachers.
- I**t is critical to learn from the experiences of existing transformative approaches**—what they have achieved and how they did it—to clarify how innovative, powerful forms of learning can be spread and sustained, especially under challenging circumstances.

The report first reviews the nature of the problem and argues that the global lifelong learning agenda calls for serious reimagining of the education landscape. It then argues that pedagogy, and specifically innovative pedagogies, must be central to any systematic transformation if leapfrogging is to be achieved. The report identifies six clusters of such pedagogies which, alone or in combination, would underpin such a transformation. (We used the shorthand "innovative pedagogies," but we could have used other terms, including "playful" or "engaging.") The report then examines factors that enable the successful implementation of innovative pedagogies, homing in on the support and empowerment of teachers, as well as structural changes in the design of schools to include hybrid models, combining both formal and nonformal. Finally, the report concludes by reflecting on the depth

of transformation that this vision implies for education systems, and how to think about fruitful near-term approaches for scaling up innovative pedagogies.

Naturally, this report drew on existing literature, especially on pedagogies, teaching, and learning. We used the foundational analysis of pedagogy established through our earlier work for the Organisation for Economic Co-operation and Development (OECD), "Teachers as Designers of Learning Environments," including the six clusters of innovative pedagogical approaches.[3] We also drew on the insights and frameworks of parallel CUE work on breadth of skills, curriculum, and scaling. In this report, we use the terms "21st century skills," "breadth of skills," and "transversal skills" interchangeably, as no single precise definition is appropriate to our analysis.

A major resource for this report was the "Global Catalog of Education Innovations," developed by CUE alongside the 2018 Leapfrogging book,[4] a compilation of nearly 3,000 cases from around the world. We also reviewed cases in the broader literature, including respondents to a 2019 PlayFutures survey. We narrowed down the cases by searching for those in teaching, learning, and pedagogy (specifically, those tagged as "playful learning") and with at least basic evaluative evidence of impact. And, given our focus on school-age learners, we excluded the examples in higher and adult education and training.

We recognize that the Catalog has limitations of comparability. Each of the "innovation spotter" organizations contributing cases used its own definitions and methodologies. The information represents a snapshot of the situation at the time the case reports were put together; each case will have developed since then, and some may have been discontinued altogether. We are less concerned with the precise histories of each of the hundreds of Catalog innovations, and much more concerned with the models and practices they show are possible.

We aim to shape understanding through our analytic frameworks and to inspire, including through the innovation cases themselves. The readership that we seek to inform and inspire are those with a policy and stakeholder interest in education around the world. Some will be education officials in local and national governments, and others will be in leadership positions in schools, associations, and networks. Some will be promoting change through teacher organizations, nongovernmental organizations (NGOs), intergovernmental organizations, and foundations. Others will be the academic experts who engage with contemporary change.

A Global Spotlight on Learning

For the first time, in 2018, the World Bank devoted its annual "World Development Report" exclusively to education, illustrating the high priority assigned to education in the global policy discourse. The report's title, "Learning to Realize Education's Promise," indicates that a great deal remains to be done to translate investments and participation in education into deep-seated learning. The report argues that countries and stakeholders must be open not only to learning about innovation, but also to innovating learning, to stand a chance of realizing education's potential.[5]

The report notes the dramatic improvements made in access to education over the years, highlighting that, "[i]n 1970, the gross primary enrollment rate was 68 percent in sub-Saharan Africa and 47 percent in South Asia. By 2010, that rate was above 100 percent in both regions…The recent expansion in schooling in low-income countries is especially remarkable in its scope and speed."[6]

The report's authors are not complacent, recognizing that even the struggle to educate all children is far from won in many locations and that globally, "hundreds of millions of youth remain out of a school."[7] But, many countries around the world have made decisive steps to increase access to education, even if much of it is still low quality, especially in Africa and Latin America.[8] Since the start of the 21st century, many countries of different income levels have recorded a rise in school enrollments, but with differing gradients (figure 1.2). The upper-middle-income countries have closed the gaps with the richest countries, especially in enrollments at the primary level. But not all gradients are upward: enrollments in the low-income countries have flatlined in recent years.

Widening Learning Inequalities

Caveats notwithstanding, there is much to applaud about increased access to schooling globally. But the World Bank's main concern, expressed as "the learning crisis," is the substantial gap between attendance in schools and the actual learning taking place in many countries and communities. "Children learn very little in many education systems around the world: even after several years in school, millions of students lack basic literacy and numeracy skills."[9] In Mozambique and Nigeria, for example, after more than three years of compulsory language education, 80 percent of students cannot read simple words of Portuguese and English, respectively.[10] In Uganda, half of the poor children are still in school at age 14 but they are three or more years behind grade level.[11]

The consequence is gaps in minimum proficiency in mathematics and reading between high-income and the other sets of countries (upper-middle, lower-middle, and low-income), as shown in figure 1.3. While there is a clear gap in proficiency between low- and high-income countries, it is also possible to see differences between the high- and upper-middle-income countries, on the one hand, and the lower-middle and low-income countries. These are by no means simply North-South inequalities.

The mass schooling systems of the developed countries also face significant challenges of education

Enrollment Rates in Primary and Secondary Education, by Country Income Group
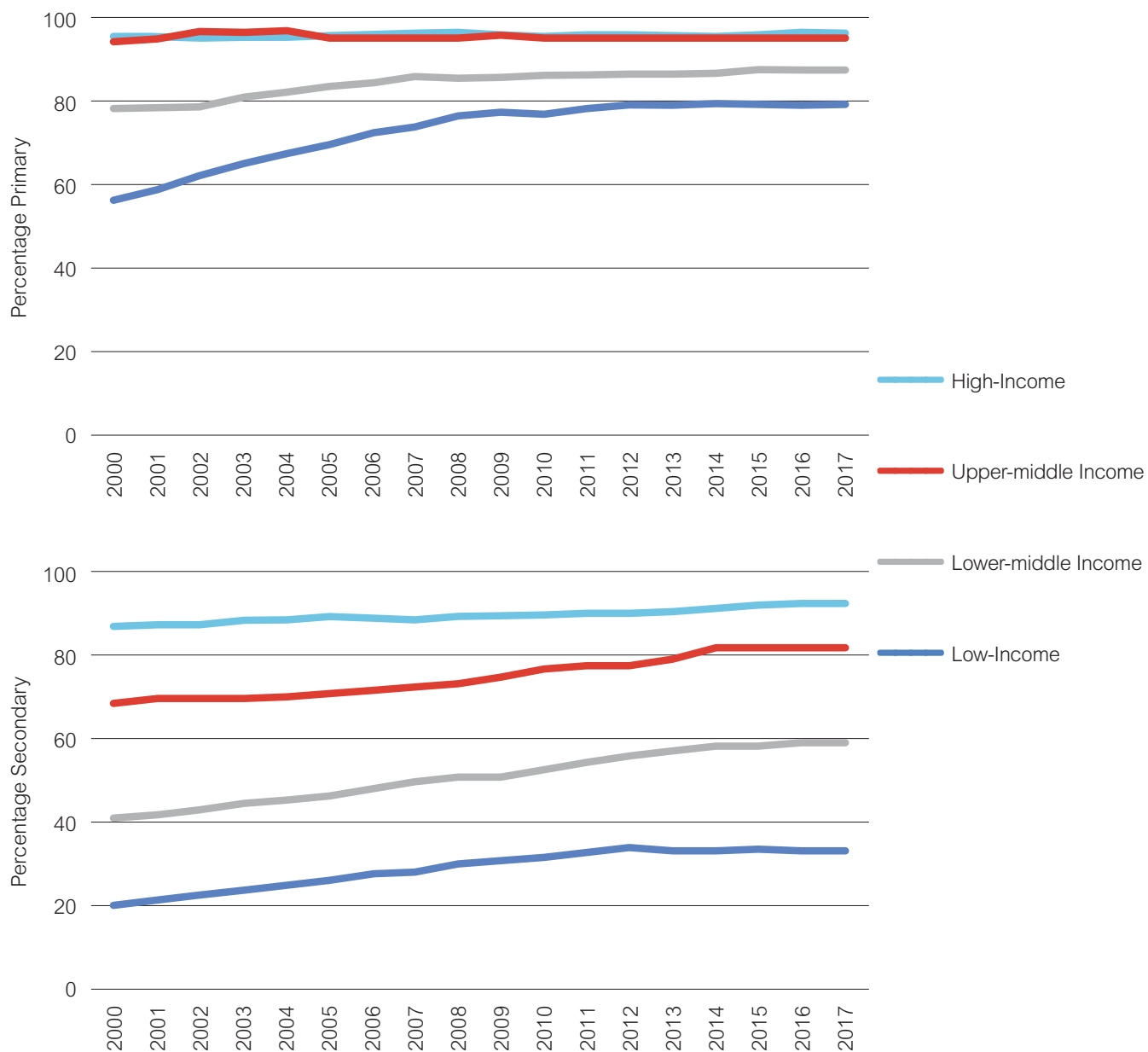
Source: World Bank Education Statistics (2019).

Note: Enrollments are measured by "net enrollment rates," defined by the World Bank as, "Total number of students in the theoretical age group for education level enrolled in that level, expressed as a percentage of the total population in that age group."

underperformance and inequality.[12] Across the European Union, more than 10 percent of children leave school at the lower secondary education level or even earlier, and remain outside education and training.[13] And, while average per-student expenditures increased by 17 percent between 2005 and 2013 in the high-income OECD countries, Programme for International Student Assessment (PISA) data show no significant improvement in test scores over the same period.[14] In PISA participating countries, one-third of 15-year-olds do not reach minimum proficiency levels in reading.[15]

There is thus a double crisis: (1) the lack of learning despite attendance at school, which is a basic quality issue, and (2) the amplification of inequality, which "severely hobbles the disadvantaged youth who most need the boost that a good education can offer."[16]

Inherent in this learning crisis is the stark reality that a great deal of teaching, including in the high-income countries, is not succeeding in embedding the knowledge, skills, and dispositions that societies and economies demand. Moreover, the distribution of this failure is highly unequal. This state of affairs makes leapfrogging all the more urgent, but it also underscores the scale of the task: to first stop the tide, and then to reverse it, with a veritable sea change.

Figure 1.3

Primary School Students Above Minimum Proficiency in Mathematics and Reading, by Country Income Group
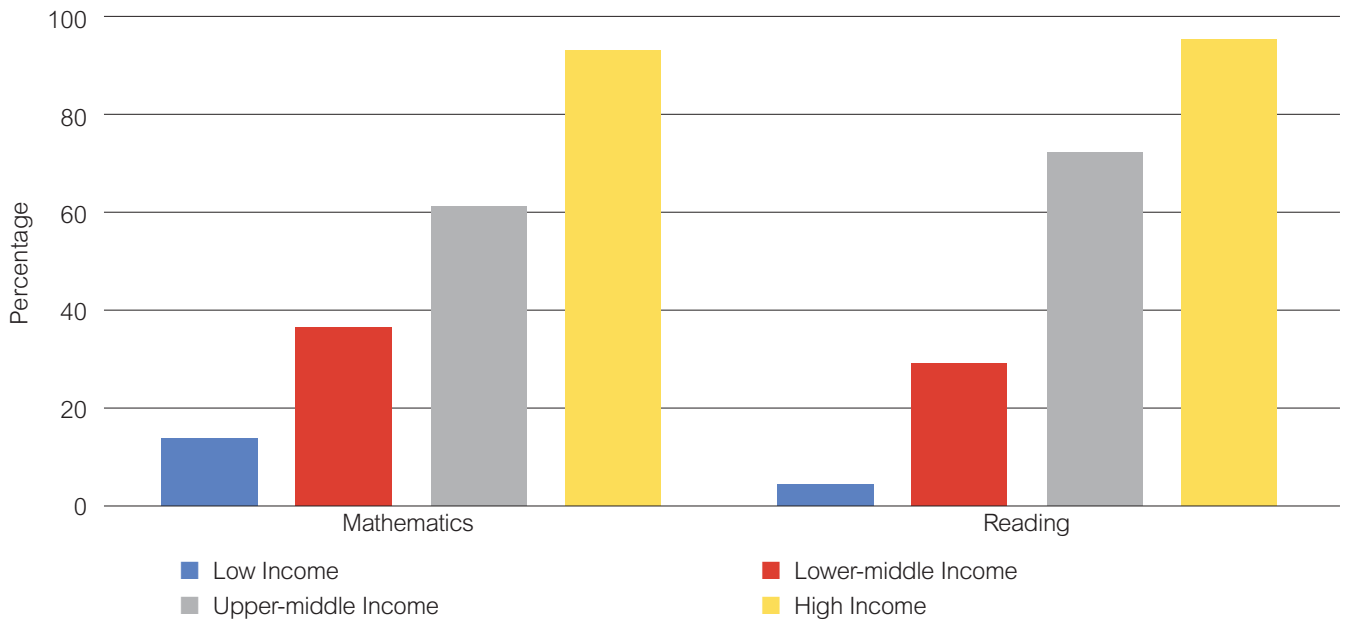
Source: WDR 2018 team, using "A Global Data Set on Education Quality" (2017).

Note: Bars show unweighted cross-country median within country grouping. Minimum proficiency in mathematics is benchmarked by TIMSS assessment and PIRLS assessment is used for reading. Country income levels are as defined by the World Bank

Wider Economic and Social Inequalities

Broader trends of inequality impact on the inequalities in education. Income inequality today is at its highest level since the 1980s.[17] This has a direct effect on education, because, "much empirical research finds that countries with higher levels of income inequality tend to show lower levels of social mobility across generations…[and that] disparities in performance related to socio-economic status develop early and widen throughout students' lives."[18] These patterns are especially marked in certain regions; in Latin American countries, for instance, income inequality is greater and social mobility is less prevalent than in most OECD countries.[19]

Therefore, the global expansion of education has taken place in the context of income inequalities that are already wide and widening further, which education has barely dented so far. The shift in systems of education from elite to mass to universal has been a triumph, but as we have seen, it has not resolved the learning crisis.[20] Nor could expansion of education by itself bring about greater income equality, for as more students access one level of education, the key filters move upwards; those left behind are even more excluded, while those who move up the rungs of the education ladder find no guarantees of the expected payoffs. In any case, the aim should not be for some social groups or individuals to move ahead of others, without altering inequality. Rather, the goal should be for whole countries or sections of the population to move up, thereby closing gaps and narrowing inequalities—in other words, leapfrogging inequality.

Leapfrogging to More Ambitious Heights

The challenge of leapfrogging becomes even more daunting because of the continual growth in global ambitions about what education can achieve. We focus here on three mega-ambitions that reveal the upward pressure of global expectations: the breadth and depth of skills agendas, 2030 targets, and lifelong learning. Far from standing still, the goals are being expanded in bold new directions. The challenge is to ensure that this extension does not leave those who are already behind, still further behind, and more surely out of reach.

Ambitious Agendas for Breadth and Depth of Skills

Increasingly, the focus has turned to what should be learned during childhood and adolescence, combined with the realization that many school curricula have been heavily dominated by academic knowledge. In an era of rapid change, this is seen as limited and old-fashioned. The argument for breadth of skills is clearly summarized in the 2018 Leapfrogging book:

> Many educators argue that the best way for schools to prepare young people for future success is to help them develop a broad range of learning, work, and life skills that they can deploy all their lives, regardless of what the future entails. This does not mean jettisoning academic learning, but it does mean using teaching and learning approaches that enable students to delve deeply into subjects, while also fostering a range of what some refer to as "21st century skills." At the core, education systems must move from prioritizing knowledge acquisition to prioritising both knowledge acquisition and the development of skills needed to use that knowledge effectively in new contexts over time.[21]

This passage shows the ambition of the breadth of skills agenda, in which breadth refers to the many different skills and capacities now needed. Even more ambitious, breadth cannot be at the expense of depth, because the 21st century skills needed for problem solving and knowledge transfer depend on deep understanding. These are very ambitious extensions of the goals of education.

The Role of Pedagogy
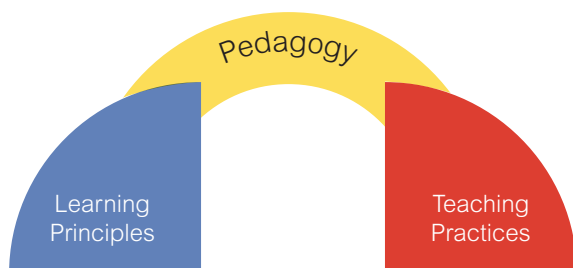
These ambitions have come to define curricula around the world. A parallel CUE study concludes that "there is compelling evidence of a shift in education systems toward broadening education provision beyond traditional disciplines and focus on literacy and numeracy."[22] One of the reasons to focus so strongly on pedagogies and learning, as we argue below, is because of the gap between the broad competence-based visions and curricula and the actual learning taking place in classrooms Pedagogy, therefore, acts as a bridge between principles and practice (figure 1.4).

Ambitious 2030 Targets

Expectations in all countries for children, their rights, and their opportunities, have risen notably over the past three decades or so. A very tangible expression of the increasing ambitions for education are the Sustainable Development Goals (SDGs), which the international community set in 2015 for achievement by 2030. The targets most directly related to education are grouped together under Goal Area 4. They cover:

• universal pre-primary, primary, and secondary education
• universal youth literacy and numeracy
• gender equality and inclusion
• equal access to technical, vocational, and higher education and relevant skills for decent work
• education for sustainable development, peace, human rights, and global citizenship[23]

The SDG's education targets are demanding of teaching and of teachers, in insisting that education should be high quality and equitable and should include relevant work skills, as well as contribute directly to sustainable development. Beyond the targets that explicitly address education, education is also expected to contribute fully to the other SDGs, in such areas as the elimination of poverty, promoting good health and well-being, enhanced productivity and innovation, and the promotion of peace and justice.

The Ambition of Lifelong Learning

Lifelong learning is the overarching global goal that has been widely endorsed by the global community for the past quarter century.[24] This goal is relatively easy to endorse, difficult to formulate with precision, and still more challenging to implement.

> The lifelong learning agenda implies wide-ranging changes in the organization of education and learning—that is, it calls for deep innovation.

The SDGs and the breadth of skills movements are manifestations of this global lifelong learning goal. The 1996 Delors report, for instance, laid out an articulate breadth of skills agenda that embraced knowledge, self-realization, skills, and the capacity to pursue harmonious social relationships.[25] The lifelong learning agenda implies wide-ranging changes in the organization of education and learning—that is, it calls for deep innovation.

Realizing lifelong learning goes well beyond education ministries and even well beyond formal policymaking. Its realization is as dependent on the foundation laid during the early years of childhood and adolescence as it is on creating opportunities beyond schooling. And since lifelong engagement in learning relies so heavily on the actions and designs of communities and individuals, these individuals must be equipped

during childhood and adolescence with the values, attitudes, and habits to continue to learn. This includes engagement in learning and playfulness. These are not warm cozy notions of little relevance to the serious challenges of education leapfrogging; rather, they are fundamental elements of this foundation for lifetimes of learning.

The Innovation Imperatives: Meet Global Goals, Cope with Change, Redress Inequalities

The learning crisis coupled with the high (and rising) global expectations for education are the first main reason for the innovation imperative.[26] Widespread innovation in education is required to make a serious dent in learning inequalities and to make progress toward implementing lifelong learning, 21st century curricula, or meeting the ambitious sustainability targets by 2030. Furthermore, this innovation must take place in the mainstream of schooling, and not be confined to tinkering around the experimental margins.

Second, innovation is imperative because of the rapid changes underway in the economy, in skill demands, and in society. This argument has an immediate political resonance, because all can recognize the facts of rapid change in technology, skills obsolescence, global relations, and social behavior and hence the need for education to respond to these changes.[27] However, it is much easier to acknowledge the facts of change than to identify how to respond to them, because they give conflicting signals about which directions to move in. On the one hand, rapid change argues for promoting student flexibility and adaptability, while on the other hand, an individual's stability must be anchored in identity and a sense of belonging, to withstand turbulence. Inherent in both is depth of understanding and reflection. Thus, innovation to equip children and adolescents to respond to change arguably can be seen as heading in different directions at the same time, to promote:

- **Flexibility and adaptability**, defined as the ability to make connections, to adapt methods creatively, and to solve unfamiliar problems
- **Deep understanding**, rather than a broad superficial introduction to a large volume of content. This means both mastery of knowledge as well as facility with the processes of learning.
- **A solid ethical, social, and cultural foundation** so that individuals can cope, and even thrive, with instability and turbulence

In addition to the innovation needed in education systems to achieve these qualities at scale, innovation must disproportionately affect those whose education achievements are lowest—in each country, and globally—if the innovation is to leapfrog inequality.

Leapfrogging Learning: Why Pedagogy is So Important

Pedagogies to Address the Quality of Learning

Pedagogies are located in the engine room of education. Here, the core elements of learners, educators, content, and learning resources come together through pedagogies and assessment practices, different uses of educational time, and educators and learners working collaboratively or individually in different ways.[28] Far-reaching transformation in education implies changes in the conditions under which the core elements are able to work.[29] Unless there is transformation within pedagogy itself, however, these other changes will have only very limited impact on actual student learning. For example, introducing a change to learning resources, such as computers or tablets, will not impact student learning if educators' teaching practices remain unchanged. Additionally, pedagogical innovations that improve breadth and depth of skills also address access to and participation in education, because they are designed to engage those students most affected by education inequalities. [30]

Evans and Popova, in their global review, "What Really Works to Improve Learning in Developing Countries? An Analysis of Divergent Findings in Systematic Reviews," found marked differences in recommendations and suggested "that these divergent conclusions are largely driven by differences in the samples of research incorporated by each review."[31] Such divergences notwithstanding, they found that three broad forms of intervention emerge with some consistency: (1) pedagogical interventions that tailor teaching to student skills; (2) teacher training interventions, often linked to other pedagogical interventions; and (3) improving accountability through contracts or performance incentives.[32] In our view, the third set of approaches, around contracts and performance incentives, is too specific as a base for broad leapfrogging strategies, and too far removed from learning itself.

Hence, we followed this evidential lead and focused on the first two of these interventions as foundational to our examination of how to leapfrog in education. Providing additional instruction for children with difficulties is effective, as is adaptive instruction and teacher coaching.[33] Improving teaching methods, including mother tongue and bilingual education, combined with remedial help for those who are struggling, are among the most effective interventions.[34] Investing in better pedagogies increases learning outcomes and is cost-effective compared with many other interventions. Tech-rich learning programs are effective, but only when they impact the daily school experiences of children; they should connect with the curriculum and avoid limiting useful teaching time during school hours.[35]

Some studies have suggested that the learning benefits of "child-centered" pedagogies are inconclusive.[36] We argue against presenting the choice as between "child-centered" and "teacher-centered," because any powerful learning environment needs both. In any case, the dichotomy is flawed, and the concept of pedagogy is often poorly elaborated. There is need to

recognize the creative and sometimes contradictory nature of teaching and pedagogy. These points underpin, and are elaborated further in, Section 2.

Pedagogies to Realize Ambitious Curricula

The further set of reasons for the pedagogy priority follows from disappointment with the extent of implementation of 21st century curricula (as outlined by Esther Care and her colleagues).[37] Specifying ambitious menus of knowledge and skills that young people should acquire is very different from ensuring that they actually learn, and this is especially the case under challenging circumstances in which many teachers are ill-prepared and ill-rewarded. Reimers and Chung home in on the gulf between visions and implementation—which they call the "critical void" of not knowing "how to produce systemwide change to enable teachers and students to teach and learn in today's world."[38]

Improved curriculum and assessment frameworks say little about how to implement the new content and its associated competencies for which the focus needs to be on pedagogy, to understand how to implement curriculum and to align it with assessment requirements. Section 2 picks up this theme, noting that there is widespread advocacy of "active" and "child-centered" pedagogy in vague and unspecified ways, without analysis of what these pedagogies actually are and the challenges of their implementation.

Notably, the pedagogy priority also stems from the breadth of skills movement itself. For the most part, the transversal 21st century skills are modeled by pedagogies—collaboration by group learning, curiosity by inquiry, critical thinking by student discussion, etc. The ambitions for learning laid out at the beginning of this section, therefore, bring with them the need to focus closely on pedagogy.

The Burden of Proof

Many of the avenues proposed in this report lack watertight supporting evidence. Yet, given our focus on the emerging phenomenon of innovation, and given that real-world approaches comprise combinations (rather than pure treatments) in richly divergent contexts and cultures, there will always be limits to robust proof. Building up education research systems is also a long-term enterprise. Yet, so urgent is the learning crisis, and so clear the innovation imperative, that we cannot use the lack of a compelling evidence base to justify inaction.

Neither are we operating in the dark. Evidence can support broad directions and principles, even if it cannot show whether a particular application is effective. In fact, our analysis is coherent with the "research-based innovation" approach proposed by Bereiter and Scardamalia. They suggest "fruitfulness" as a key research criterion to analyze innovations.[39] Does this idea or initiative have potential? Is it worth developing further? Along with fruitfulness, practitioner knowledge and experimentation by the innovators whose practices we reviewed for this report provide additional insight.

The burden of proof now shifts to those who might advocate inaction for want of evidence, over trying something new and different. The failings of much current teaching are described in painful detail throughout the global reports referred to in this section. The evidence regarding the need for change is very robust.

By design, system transformation cannot have a highly developed evidence base. Scholars studying system transformation argue that different standards of evidence must be used. Todd Rose, an expert in system transformation at Harvard's Graduate School of Education, wrote, "to truly embrace the possibility of system transformation, we need to not only embrace a new purpose of the system, but also new

ways of understanding evidence-based decision-making, including expanding beyond approaches such as randomized controlled trials that may be helpful in guiding incremental reforms but are not well suited for transformational change."[40]

Such is the urgency of the learning crisis that this theory should not stop the endeavor and the bold experimentation. This is not the same thing as advocating frenzied short-term activity at the expense of reflective long-term strategy. The aim of this report is precisely to contribute to such long-term thinking and planning. In the next section, we examine in depth the types of innovative pedagogy that are the most fruitful for the quest to leapfrog education, so that all young people develop the full suite of skills and competencies they need to thrive in a fast-changing world.

Innovative Pedagogies Are Essential for Leapfrogging

Understanding Pedagogy to Improve Teaching

Pedagogy is the dynamic relationship between learning, teaching, and culture.[41] Culture in this sense is the pedagogical practice that is more intimate, creative, intuitive, and responsive to particular contexts, incorporating local beliefs about childhood and teaching.[42] Reports about innovative teaching commonly discuss curriculum and content, new skills, assessment practices, school governance, and other school variables, which may have only indirect connections with pedagogies and what happens in the classroom. Much discussion of pedagogy is about defining principles (for example, that pedagogy should be student-centered and personalized for the learner), or the so-called 21st century skills, rather than showing what these principles look like in terms of teaching practices.[43] Paradoxically, international organizations arguing the importance of pedagogy in the policy agenda tend to avoid any clear or detailed position on the models that should underpin teaching and teacher education.[44] But, it should also be recognized that conceptualizing pedagogy is not easy. To begin with, even teachers tend not to like to talk about teaching,[45] and when they do, they refer to ideals rather than the pragmatic practices and approaches that they use on a daily basis.[46]

Recent reports about promising innovations have emphasized pedagogy,[47] but even in them, the conceptualization of pedagogy is quite often vague and trapped in the dichotomous "child-centered" versus "traditional" (teacher-centered) debate.[48] Cerqua and colleagues have provided one of the most compelling discussions of the concept of pedagogy as described in UNESCO's and OECD's narratives.[49] They argue that the current vague conceptualization of pedagogy limits the effort to include it in the international policy agenda. In the quest to shift teaching practices and teacher training toward more "child-centered" and playful learning principles, these narratives overemphasize and even misuse the idea of "structured teaching" as commonly associated with traditional, teacher-centered practices. However unintentional, this is misleading, because it characterizes "child-centered" approaches as unstructured and suggests that students are necessarily passive in teacher-centered approaches and, for example, that the lecture is perceived as a predominantly negative practice.

An exception is the LEGO Foundation's work on playful learning, and its recent white paper, "Learning through play at school: A study of playful integrated pedagogies that foster children's holistic skills development in the primary school classroom," which specified eight different pedagogical families of approaches.[50] These are: active learning, cooperative and collaborative learning, experiential learning, guided discovery learning, inquiry-based learning, problem-based learning, project-based learning, and Montessori education. But we argue that there is a broader set of pedagogical approaches that must be considered to effect deep system change.

To help fill this gap of policy-related guidance on pedagogy, the OECD worked in 2018 to deepen the understanding of innovative pedagogies in two fundamental ways:

- To better understand how to implement curriculum goals, with pedagogies offering a bridge between new content, skills, and competencies, and international and national assessments of student learning. Under this scenario, pedagogy is the "technology of instruction" that determines how schooling inputs are used in practice to impact learning outcomes.
- To help populate and navigate within the innovation landscape, by offering road maps to teachers and policymakers. Pedagogies connect innovative cases, and link practices and methods with learning principles and theories of education.[51]

Mapping the Landscape with Clusters of Innovative Pedagogies

A map is a tool that indicates ways of moving from one point to another. Using this metaphor, pedagogies are like maps for connecting broad and abstract learning principles with different teaching practices rooted in local contexts. Teachers and schools can use pedagogies both to *deepen* their understanding of what they are doing—connecting with learning principles—and to *broaden* their understanding by combining it with other experiences and designing their context-specific learning environments.

With pedagogy understood as intersecting theories and practices, the OECD's recent analysis featured six clusters of innovative pedagogies (figure 2.1).[52] These pedagogical clusters achieve two things: (1) work as a matrix to group teaching approaches and identify general pedagogical approaches, and (2) retain practice at a level so that it translates learning principles into specific teaching practice to achieve the new learning goals, without falling into ready-made prescriptions.

> Pedagogy is the "technology of instruction" that determines how schooling inputs are used in practice to impact learning outcomes.

Figure 2.1

The Six Clusters of Innovative Pedagogies

Blended Learning
Gamification
Computational Thinking
Experiential Learning
Multiliteracies
Embodied Learning
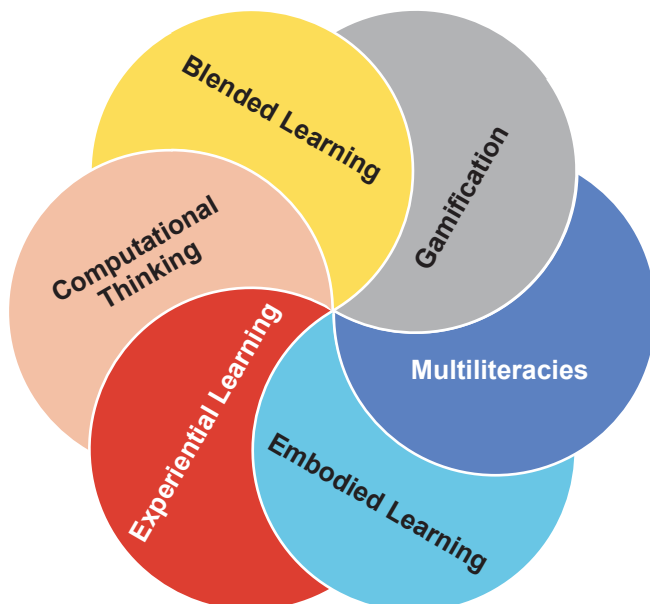
Using Pedagogical Clusters to Illuminate Leapfrogging Pathways

An ongoing challenge for policy is that richly diverse new models of teaching tend to be reduced quickly to simple (and simplistic) labels, such as "child-centered" or "constructivist." This unfortunate tendency makes pedagogical innovation appear to be a receptacle of good intentions, with little specified beyond that pedagogy must be active and student-centered. This report helps bridge the gap between local innovative experiences and theories of learning, by relating new pedagogies to the literature on their impact and who can effectively implement them. It contributes to understanding both

> This report helps bridge the gap between local innovative experiences and theories of learning.

the factors that enable teaching the new skills, and also more engaging, diverse, and fruitful ways to teach subject knowledge—in short, jumping ahead in the teaching and learning element of the leapfrog pathway.[53] Here, we revisit the OECD clusters of innovative pedagogies, based on international reports that have discussed effective implementations of the approaches or similar ones, and on fine-tuning the approaches to be both culturally sensitive and cost-effective to particular challenging contexts.[54] In particular, we are interested in how pedagogical approaches can help teachers develop learning designs that target those skills that most impact the economic and social lives of students, enabling them to become active agents in their communities.[55]

Blended Learning: Using Online Learning to Teach to the Right Level

What is Blended Learning?

Technology use in schools has surged worldwide: the global EdTech market was estimated at $91 billion in 2012, and nearly tripled in size to $252 billion by 2016.[56] Not all EdTech designs are created equal, and investment in educational technology can come in many forms.[57] One of these is blended learning, in which online learning delivers content in new, more flexible ways and better differentiates students' needs. Students have some control over the content, pace, timing, and location of their learning, which in turn, allows teachers to further differentiate instruction based on varied student progress.[58]

In the **rotation model** of blended learning, a group of students rotate between a school lab and face-to-face classroom interactions with the teacher, with individual students following a customized schedule. There are other blended learning models—with flipped classrooms the best known—but for leapfrogging to flourish, the rotation model imposes less pressure on schools (that may not be tech-rich), and on families

and students (who may not have computers, the internet, a quiet place for homework, or even sufficient time after school hours, because of work demands).[59]

Figure 2.2 illustrates the pedagogical continuum for blended learning. The left end (theoretical models) shows the core learning principles defining this cluster of pedagogies. Some of these principles are common across innovative pedagogies, such as active learning, inclusiveness, and cultural relevance. To the right (discrete practices), are particular pedagogies that, at the very far end, become countless very local teaching episodes. Note that within the rotation model, there is the discrete practice of station rotation and, within station rotation, there is the example of particular online software.

The Significance of the Rotation Model of Blended Learning for Leapfrogging

Blended learning offers more affordable and accessible—and therefore viable—solutions than many schools are able to provide through strictly teacher-led instruction, especially when there are no alternatives to the technology product being offered.[60] Online content is particularly suited to situations in which a face-to-face educator is not affordable or cost-effective.[61] This could include situations where students are geographically isolated, in and out of school because of violent conflict in their region, or are home schooled with access to virtual education. Compared with only face-to-face instruction or only online instruction, blended learning may be preferable because of the instructional elements added by the teacher.[62] Some maintain that blended learning can incorporate the most effective aspects of each type of instruction.[63]

Blended learning can make significant contributions to social and emotional learning and to student engagement.[64] Kumi-Yebaoh and Smith suggest that blended learning allows students to progress at speeds sensitive to their different needs, fostering tech-based

Figure 2.2

Blended Learning on the Pedagogical Continuum
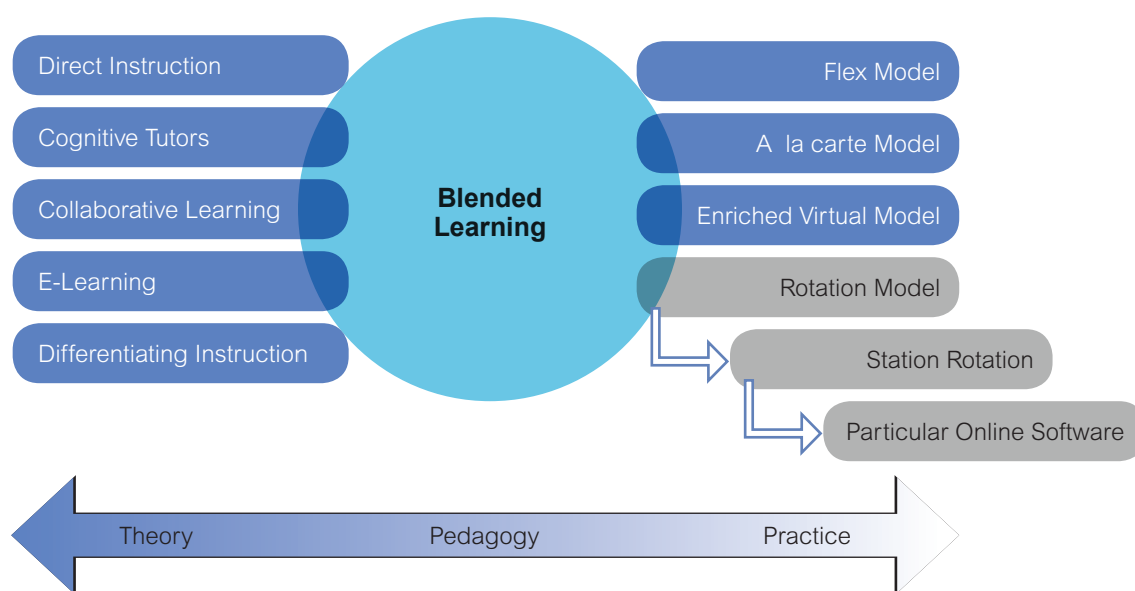
Source: Based on Paniagua and Istance (2018, p. 38).

Note: The theoretical models and discrete practices are illustrative examples, not exhaustive categories.

competencies and autonomy.[65] They also argue that accessing online content through blended learning facilitates greater peer-to-peer interactions, thus promoting collaboration and responsibility. With the rotation model, instructors participate in small-group discussions with students, creating more meaningful dialogue between teachers and students. The impressive review by Murphy et al. suggests that when schools implement blended learning, they are able to personalize learning through self-paced programs, online instructional content, and the facilitation of small-group discussions for students with the greatest academic needs.[66]

Specialized programs and online platforms can also enhance learning experiences that are relevant to real life, and thus promote engagement and authentic learning through activities including performing music,

crafts, and science experiments. Some researchers have found that a seamless integration of interactive technology is helpful to bridge formal and nonformal learning experiences for students.[67]

Implementing the Rotation Model of Blended Learning in Schools

A significant challenge in many countries is difficulty in gaining access to technology. Internet costs, although decreasing, are still high for many households; in such countries as Mozambique, Guatemala, Botswana, the Philippines, or Bolivia, internet access in schools is a luxury, particularly in rural areas.[68] Computers pose another challenge. While nearly 45 percent of schools in India have electricity, only a tiny minority (0.2 percent) have access to computers.[69] Further, providing appropriate technologies is only a part of the challenge, be-

cause most countries continue to focus on delivering digital resources to teachers rather than on developing standards for the pedagogical use of technology.[70]

Some solutions are available, as illustrated in boxes 2.1 and 2.2. Previously downloaded material can significantly reduce dependence on an internet connection. The rotation model also allows for the combination of different delivery models, to avoid the expense associated with full online learning.[71] The proper implementation of blended learning depends on the appropriate integration of information and communications technologies (ICTs) according to pedagogical designs, so that professional development can be focused on instruction and not just on technology.[72] Therefore, blended learning should be content-specific and not simply tech-rich.

Computational Thinking: Computing to Improve Problem-Solving Skills

What is Computational Thinking?

Computational thinking implies much more than teaching computing in schools. It is a problem-solving process that is central to the academic discipline of computer science, but it can also be applied to other disciplines and does not require the use of computers.[73] While a variety of similar terms exist in today's lexicon, including coding, computer programming, and algorithmic thinking, the overarching link of computational thinking is using digital literacy and algorithmic thinking to formulate, analyze, and solve problems.[74] This pedagogical cluster moves away from solely teaching ICT skills, to understanding how

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Box 2.1: Blended Learning Literacy Instruction in Elementary Education in the United States

In an urban elementary school in the United States—in which more than 70 percent of students come from low socio-economic backgrounds and 18 percent of students speak English as a second language (ESL) —teachers adopted a blended learning approach to English language arts instruction that predominantly used **Lexia Reading Core5**. Its online component provides systematic, personalized reading instruction. The researchers drew on previous analysis that showed how parts of blended learning approaches promote phonological awareness and word identification skills in kindergarten children struggling with reading, and how the approaches promote reading comprehension for both children from low socio-economic backgrounds and English learners (ESL students). The Lexia online reading program targeted six strands of reading: phonological awareness, phonics, structural analysis, automaticity or fluency, vocabulary, and comprehension. Activities in these strands are systematically aligned to the reading foundational skills, reading informational text, and the literature in the classroom where they are used. Each classroom had two to eight computers for student use, or students used computers in the school library. They worked with the online component for 20-80 minutes per week, as recommended by the software developers, for an average of 28.5 weeks.

With the exception of students in the first grade, the English learners in the study had comparable or greater gains when compared with non-English learners. These gains remained significant when controlling for student grade level, entry literacy level, and the condition of ESL. This case is particularly relevant for leapfrogging, because it shows how blended learning designs provide supportive benefits for students from low socio-economic backgrounds and English learners, who so often lag behind their peers in reading development.

Source: Prescott et al. (2018).

Box 2.2: African School for Excellence: Providing Quality Education at a Lower Cost

The African School for Excellence (ASE) is a self-sustaining, affordable private secondary school in South Africa with an innovative rotational classroom model that is based on the principles of blended learning and experiential learning. ASE uses technology, trainee, and peer teachers, and an environment of high expectations and rapid feedback to leverage a small number of skilled teachers. The school aims to help disadvantaged South African youth become world-class scholars and leaders who will transform their communities.

In the classrooms, students rotate between teacher-facilitated lessons, small-group peer-learning activities, and individual work on computers that is supervised by trainee teachers who are themselves university students. Each class is separated into three parts: (1) a peer-learning component to encourage teamwork and students learning from each other; (2) time for each student to work independently; and (3) a class dialogue. A qualified (and quality) instructor and two trainee teachers oversee all three parts. The approach is inquiry-based and harnesses technology, particularly in the independent work rotation, where free products such as Khan Academy support the learning. A significant advantage is that for each cycle of three rotations, a fully qualified teacher is only needed in one rotation (instructional) while in the others, trainee teachers can manage the classroom. This is also important given the lack of highly skilled, trained teachers in South Africa.

Students in the school outperform the wealthiest students in the country by 2.3 times in mathematics and 1.4 times in English. At the same time, the per-student cost of $800 a year is low when compared with South African averages that are in the range of $1,400 to $16,500 per year.

In sum, ASE provides quality education at the same or lower cost when compared with similar schools, because the rotational model allows it to hire a smaller number of highly skilled teachers while keeping class sizes small. It also advances learning by making the teacher a facilitator rather than a direct instructor and thus promoting a more child-centred approach. This offers a good example of engaging students in their own learning through peer-to-peer practice.

ASE represents a powerful model for low-resource contexts, since the program is scalable.

Source: Shrayber (2017).

scientists use computers. This makes science, mathematics, and creativity as taught in schools more closely resemble the professional practices in these fields.[75]

Computational thinking brings opportunities for leapfrogging when it is focused on students' acquisition of problem-solving and computer science competencies, an approach we call "computing-based, problem-based learning." Berry shows the parallels between problem-solving skills and computing, including the following:

- **decomposition**—the capacity to break down complex problems into many smaller ones
- **algorithms**—identifying and describing step-by-step processes
- **debugging**—locating and removing errors and abnormalities

Yadav et al. argue that just as basic language arts helps children communicate and express themselves, computational skills allow students to understand and manipulate all kinds of information systematically and

Figure 2.3

Computational Thinking on the Pedagogical Continuum
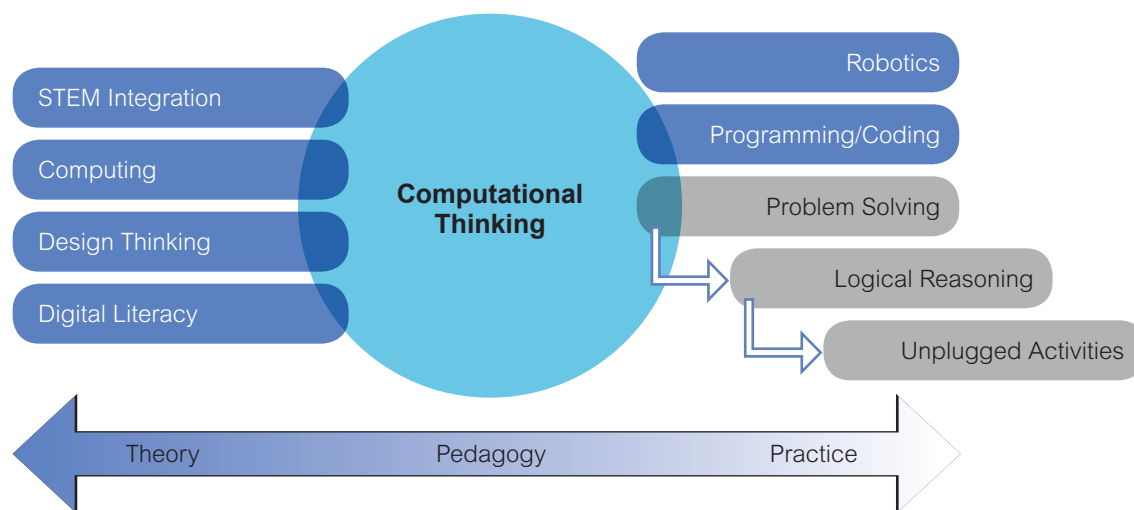
Source: Based on Paniagua and Istance (2018, p. 38).

Note: The theoretical models and discrete practices are illustrative examples, not exhaustive categories.

efficiently.[77] Figure 2.3 illustrates the pedagogical continuum for computational thinking.

How Computational Thinking for Problem Solving is Important for Leapfrogging

Computational thinking brings opportunities for leapfrogging when it is focused on students' acquisition of problem-solving and computer science competencies. A computational thinking mindset opens possibilities for students to create, design, and develop technologies, tools, and systems that can improve local communities.[78] At the international level, evaluations of active learning (which includes aspects of computational thinking) have been positive in many countries, although there are scaling challenges when initiatives are donor-funded and one-off.[79]

This pedagogical cluster is particularly promising for enhancing the breadth and depth of skills most need-ed to improve learning. Kolodner argues that computational thinking is in essence a set of problem-solving abilities that transfers across disciplinary domains. Others have suggested the value of computational thinking, especially to promote multidisciplinary teaching and learning.[80] The wide range of skills needed in computational thinking provides a solid foundation for multidisciplinary learning, including the following issues:

- coping with open-ended problems
- persisting in challenging cases
- reasoning about abstract objects
- using models to simulate scenarios
- working with ambiguity
- breaking down ideas and challenges into smaller parts
- abstracting themes[81]

Implementing Computational Thinking for Problem Solving in Schools

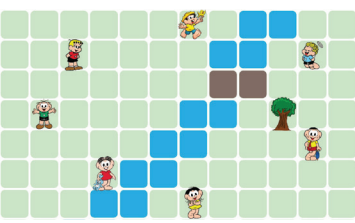A popular approach being tried in many countries is computational thinking "unplugged" (box 2.3), in which computational, problem-solving skills are taught in a low-tech manner.[82] Unplugged activities embedded in problem-solving stories can produce contextually rich scenarios within which to apply computational thinking.[83] Although unplugging removes the need for computer access, students nevertheless need to connect and experiment with computational tools and resources. This implies some balance between plugged and unplugged activities for the approach to be effective.[84]

Computational thinking for problem solving is demanding of pedagogy and teaching capabilities. Even if some schools are fortunate to have the help of specialized computer staff, all schools face the challenge of building sufficient capacity in computer science principles among regular teachers so that the teachers can apply the principles for young students.[85] This is about pedagogy, and should not become too focused on technological tools (a temptation that is

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Box 2.3: Unplugged activities: computational thinking skills without computers

Unplugged experiences address barriers such as lack of knowledge about computer programming languages or limited access to computers. This approach is especially useful and accessible for novices and younger students. **An unplugged project**, based at Canterbury University in New Zealand, offers activities, games, magic tricks, and competitions to show children the kind of thinking that is expected of a computer scientist. The project has enjoyed widespread adoption internationally and has been translated into 12 languages. In the image below, Brackmann et al. offer useful illustrations of unplugged activities and how they relate to computational thinking skills.

Plantar un árbol [illustration] 1.—— 2.—— 3.—— 4.—— 5.—— 6.—— 7.——	**"Decomposition" activity:** Students had to break down many problems (e.g. Plant a tree) identifying all the steps necessary to solve it. Other examples were: Wash Hands, Prepare breakfast, Take an elevator, Tie a shoe, etc.	Decomposition Algorithms
[grid map illustration]	**"Monica's Map" activity:** A map with many characters is shown to the students and they have to find the shortest route between them using only up, down, left and right arrows ($\rightarrow$, $\leftarrow$, $\uparrow$, and $\downarrow$). On a second moment, they should use multipliers (i.e. $\rightarrow \rightarrow \rightarrow \rightarrow \rightarrow = 5x\rightarrow$) to write down the solutions.	Pattern Recognition Algorithms
LOS ELEFANTES **X =** [ ] **X** elefante(s) se balanceaba(n) sobre la tela de una araña como veía(n) que resistía fueron a llamar a otro elefante. **X ← X + 1** **SÍ X<10, REPETIR ESTROFA**	**"Elephants" activity:** uses a popular students song as exemplification of how a song can turn to an algorithm. In this particular song, the repetition, variables, and conditionals are worked through the increase of the amount of the elephants. Every verse had an increase of the variable until it reached a number equal or bigger than 10.	Abstraction Pattern Recognition Algorithms

Source: Brackmann et al. (2017), Bell et al. (2009), and Kotsopoulos et al. (2017).

also present in blended learning).[86] For example, programming is a relevant activity in computing-based, problem-solving learning, but teachers need to interpret it in the wide sense of problem solving to clarify the relationships between activities—whether when giving someone directions to navigate a city, or when programming a floor robot.

Experiential Learning: Involving Students in their Communities

What is Experiential Learning?

Experiential learning covers a group of approaches, including project-based and inquiry learning, that put learners directly in contact with what is being studied. These approaches take human experience as a central source of learning and seek to incorporate it into teaching and the design of learning environments.[87] Experiential learning is classically viewed as comprising four main elements:

- concrete experience
- reflective observation
- abstract conceptualization
- active experimentation[88]

Taken together, these represent a comprehensive learning cycle that builds on natural interest and motivation to push learners beyond their existing limits.[89]

Figure 2.4

Experiential Learning on the Pedagogical Continuum
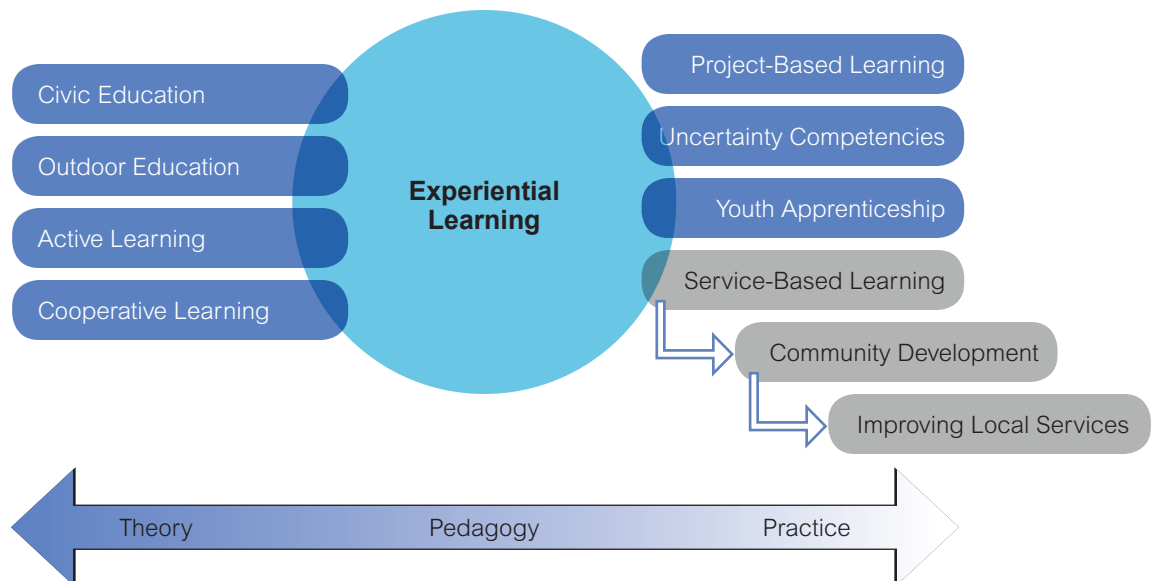
Source: Based on Paniagua and Istance (2018, p. 38).

Note: The theoretical models and discrete practices are illustrative examples, not exhaustive categories. For instance, the recent LEGO Foundation report, "Learning through play at school: A study of playful integrated pedagogies that foster children's holistic skills development in the primary school classroom," covers eight integrated approaches to teaching and learning that would be found on the right-hand side of the continuum (in the OECD report, these fall under the single cluster of experiential learning).[94]

One of the most promising features of experiential learning for leapfrogging is how it harnesses informal learning within formal contexts to create authenticity, engagement, and 21st century skills. Under this approach, learning is understood as a social activity.[90] Everyday knowledge can be interpreted within discipline frameworks, and schools can profit from skills already acquired by young people, families, and the wider community.[91] This reintroduces tacit knowledge and the social and cultural dimension into schooling, which also fosters a sense of identity and belonging in students (box 2.5).

Experiential learning can be closely connected to community development, including through school-to-work, youth apprenticeship, and service-learning programs.[92] Here we focus on service-based learning as a promising example of the experiential approach, such as the "School for Life" framework, which promotes the acquisition of skills to shape the social and economic futures of students and their communities.[93] Figure 2.4 illustrates the pedagogical continuum for experiential learning.

How Service-Based Learning is Important for Leapfrogging

Service-based learning combines community service with reflection on action (box 2.4).[95] It fosters student awareness of community needs, an ethic of service, and understanding of politics and morality. Students gain a sense of civic responsibility, which positions them to become active contributors to society.[96] Studies of service-based learning have demonstrated a positive impact on student outcomes, including standardized test performance, school attendance, grades, motivation for learning, and engagement.[97] In addition, high quality service learning has been shown to increase the mathematics achievements of low-income, rural primary school students.[98]

Box 2.4: Education for Sustainability Service Learning in Nigeria

A quasi-experimental **project on education for sustainability** in 12 schools in Oyo State, Nigeria, provided evidence of the impact of service-based learning. Like many other countries, Nigeria is facing pressing environmental challenges, including erosion, deforestation, and desertification. In the study, 264 primary school students engaged in service-learning activities that addressed real-life environmental issues in their immediate communities. There were four phases to the program:

- Preparation: Students (with teacher guidance) selected an environmental issue and ways to address it, that is, the services to perform.
- Action: Students developed a work plan to deliver the services, such as making sandbags or planting trees to control erosion.
- Reflection: Students discussed and wrote up their experiences.
- Demonstration: Students made presentations to share and further analyze what they had done.

The students exposed to the service learning performed significantly better than their peers in a control group on an environmental knowledge evaluation that assessed their competence in applying the knowledge they had gained in the program to solve immediate and future environmental problems. Therefore, this service-learning experience offered a successful alternative to traditional approaches to teaching sustainability.

Source: Ajitoni and Gbadamosi (2015).

Implementing Service-Based Learning in Schools

To secure these positive outcomes, service-based learning should follow rigorous quality standards, such as those provided in the U.S. by the National Youth Leadership Council.[99] This type of learning requires the support of professionals, both inside and outside the classroom, to offer strategic scaffolding that helps students understand and build on their service experiences.[100] Teachers need to identify student interests and how to frame these interests within local challenges and problems.[101] This calls on teachers to take professional risks that are often uncomfortable, such

as shifting from directing and instructing, to facilitating group work.[102] Warren describes four main rules for teachers: provide informed consent, establish a concrete vision, set ground rules, and provide process tools for team work.

The successful implementation of experiential learning more generally calls for a number of steps. It starts with acknowledging learners' prior knowledge and continues with class discussion about the topic. Establishing a structure and preparation for fieldwork are next, which often engages the students with professionals and organizations outside the school.

Box 2.5: Our Lady's and St. Mochua's Primary School: Providing a Pathway to the Future of Rural Communities

This small, single-site rural school in Ireland is an example of innovative pedagogy with a strong focus on entrepreneurship and empathy. The core learning goal is to ensure that each student has leadership experiences that equip them to get involved in addressing the needs of their community. The leadership experiences can be in sports, student councils, eco-committees, or the "House Cup," in which teams are formed throughout the school and older students take on the role of teacher to younger pupils.

Our Lady's and St. Mochua's Primary School emphasizes the development of emotional and cultural intelligence. In one project, "Through Roots of Empathy," students visit a newborn child throughout the year, with lessons to help them understand their own emotions and those of their classmates towards the infant. This project is complementary to another program, "Dissolving Boundaries," in which students develop empathy through engaging digitally with students on the other side of the Irish border. The school emphasizes Ireland's history and heritage, including filmmaking projects, a program that teaches students about "Old Time Games," and engineering projects done in partnership with the local business community that develop real-life improvements to the school grounds.

These programs show a strong commitment to addressing the challenges and idiosyncrasies of growing up in a rural community. While the programs revolve around experiential learning, their work with cultural heritage, including multimodal languages (such as the filmmaking projects), and with crafts and creativity, also incorporates some of the pedagogical principles of embodied learning and multiliteracies.

A 2015 evaluation gave the school high scores for learning, leadership, and management, and rated it outstanding for its overall effectiveness in learning achievements and standards. The study described the students as happy and engaged, showing pride in their work, and enjoying challenges. The evaluation also praised the support given to those with difficulties, the flexibility of thinking demonstrated, and the skilled use of ICT.

Source: Our Lady's and St. Mochua's Primary School

Proper scaffolding and guidance to allow all students to participate, collaborate, and reflect also play pivotal roles in this type of learning, and run counter to the image of experiential learning as "unstructured" teaching. Finally, providing clear assessment criteria helps students in two ways, both to evaluate their experience and to guide and structure future scaffolding.[104]

Embodied Learning: Engaging with Crafts and Creativity

What is Embodied Learning?

The brain is not the only source of behavior and cognition.[105] Embodied learning builds on research showing the involvement of the physical body and activity in learning.[106] We can go further to refer to the two fundamental, natural learning inclinations of creativity and expression[107]—when cognition is underpinned by

the act of creating something to foster self-expression, learning can become a creative experience and engage students.[108] Figure 2.5 illustrates the pedagogical continuum for embodied learning.

Makerspaces encapsulate many embodied learning principles and have witnessed significant growth around the world. Makerspaces are informal sites, inside or outside schools, for creative production in art, science, and engineering. Students blend digital and physical technologies to explore ideas, learn technical skills, and create new products through design thinking and playful learning.[109] While mathematics, technology and science are often taught separately, this approach offers a platform to achieve greater integration in science, technology, engineering, and mathematics (STEM) education.[110] It therefore holds promise to improve the quality of learning.

Figure 2.5

Embodied Learning in the Pedagogical Continuum
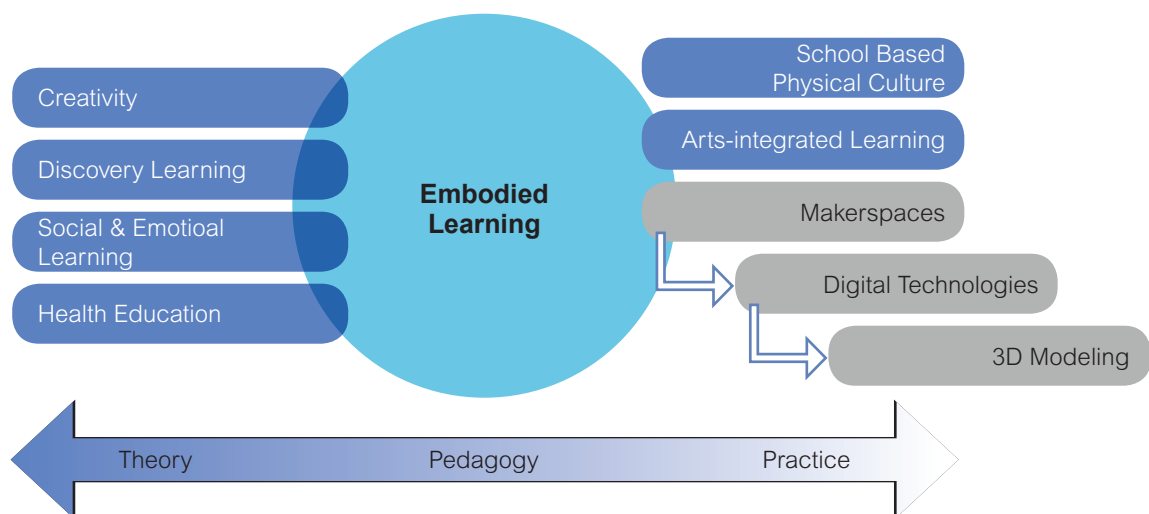
Source: Based on Paniagua and Istance (2018, p. 38).

Note: The theoretical models and discrete practices are illustrative examples, not exhaustive categories.

How Makerspaces Are Important for Leapfrogging

Makerspaces deliberately place students in contexts that require collective skills and knowledge and that represent a shift from the conceptual. This involves learning through experiences in STEM subjects and means acquiring skills in problem solving, critical and creative thinking, collaboration, and communication.[111] Makerspaces also acknowledge the strengths of traditional apprenticeships, by providing both the social underpinnings (e.g. teachers acting as mentors), which are regulated through communities, and effective skill development.[112] Furthermore, makerspaces help diversify the common portrait of the entrepreneur/creator as white, male, and middle-class. The example of electronic textiles (e-textiles) has been used to illustrate how gender norms can be disrupted,

for materials like needles and fabric shifts traditional gender roles around electronics and implicitly gives girls hands-on access and more prominence.[113] By encouraging the participation of students in playful, collaborative building activities, makerspaces promote breadth of skills and learning outcomes that are associated with playful learning.[114]

Using makerspaces with First Nations students in Canada (box 2.6), Wilson and Gobeil identify how arts and crafts can permeate STEM to foster conceptual skills such as observing, imaging, and abstracting, sensual and manipulative skills, problem-solving skills, and experience with materials and techniques.[115] Arts and crafts also can immerse students in creativity, and give them time for play and relaxation.

Box 2.6: Engaging 3D Experiences for Canadian First Nations Students

At an all-First Nations high school in Canada, a course on construction carpentry and computer-assisted design was reframed to teach students to make electric guitars through studio-design learning. The aim was to engage students by providing more choice and the opportunity to personalize what they were doing, thus allowing them to creatively explore their own ideas while meeting curricular objectives.

The course introduced students to 3D computer design and computer numeric control wood milling technology. The students learned **3D modeling** to design from blueprints and other reference materials. The computer numeric control milling machine created the design by cutting it out of wood in the classroom. Finally, the students competed the project by adding the electronics and the finishing.

As discussed by the researchers, students were surprised by the results. Building on data coming from an online survey, focus groups, and classroom observations, students reflected on the way this experience had been creative and productive, as they were left with something tangible and valuable in the end. Guitars reflected their personalities in many ways—including choice of color and laser engraving—and social media demonstrated the students' value more widely. The makerspace approach provided them not only with new hands-on skills, but also allowed them to go further and experiment with the skills they acquired. The student-friendly environment facilitated small group and one-on-one teaching, with students working at different speeds and with focus on the task, even while listening to music.

Attendance and achievement for the students attending this course went up and all the final projects were completed. Students were given plenty of autonomy to control the pace and, when they made mistakes, to learn from them and try again. Many other students who were not in the class visited, to see what was happening.

Source: Wilson and Gobeil (2017).

One aspect of makerspaces that is relevant for leapfrogging is the value they place on craft apprenticeship—both developing skills and also sharing values and social interaction.[116] In the "messing around" of experimentation, meanings are made and students themselves organize learning into more structured inquiry as they make sense of the messiness. Makerspaces are often illustrated through robotics, three-dimensional (3D) printers, and engineering, but the relevant examples are diverse and do not necessarily involve complex technology.[117] All share a focus on the design of things.[118]

Implementing Makerspaces in Schools

The overall design of any makerspace must start with the learning goals and curriculum, not the space or tools, as the goals will require very different designs. Especially where resources are limited, the design should aim for simplicity, using a few strategic tools and materials and avoiding building simple things with complex technology.[119] There need to be safety measures, flexibility, and sufficient time.[120] For those schools choosing to build a dedicated makerspace, the U.S. based National Science Teachers Association has guidelines and recommendations regarding space, utilities, and storage. Ways to reduce costs include reusing materials, partnering with external organizations with expertise in establishing low-cost labs, and using hardware with publicly available designs.[121]

Wilson and Gobeil emphasize the flexible use of "design studio structures."[122] Teachers should introduce students to a broad range of options, so that individual preferences can be discovered, with time for tinkering, experimenting, and interacting, as illustrated in box 2.7. Options include the following:

Box 2.7: Makerspaces That Integrate Art and Real-World Learning

Makerspaces are in essence STEM Labs and part of technology education, with a specific focus on art and design thinking. In many schools, they are integrated STEM approaches with hands-on activities. **School 21** in the United Kingdom offers makerspace experiences through workshop studios, in which children can create attractive work and exhibit it to the public. The school is a nonselective, state-funded institution that provides education for students aged 4-18. Its education approach revolves around using hands-on projects to develop oral skills, well-being, and real-world learning.

At the center of School 21's makerspace is "The Quad," a rectangle that serves as a flexible, multidisciplinary area. The adjoining studios are equipped to meet the demands of different creative disciplines—including 3D design, digital media and photography, design manufacturing, and fine art—which illustrates the importance of art in the school's integrated approach to STEM subjects. These workshop projects are interdisciplinary, recognizing that artists, designers, and craftspeople frequently work with a broad range of media and processes.

The majority of children start the first-year class with skills that are low for their age, because many have not had access to preschool settings. But the children settle in quickly, become familiar with routines, and develop confidence, because of the strong and immediate links with parents and caregivers. As a result of excellent teaching, children learn quickly and make rapid progress in all areas of their development. School 21 demonstrates a well-researched, innovative, and creative way of organizing subjects to promote outstanding learning. Pupils develop extraordinary skills in listening, speaking, and questioning, and become skilled in planning and redrafting their work so that they can continually improve.

Source: OFSTED, "School Report School 21" (2014).

- **Demonstration lectures**, which present open-ended challenges together with how exemplary creative professionals have previously addressed them with skills, tools, and knowledge
- **Students-at-work**, which give students autonomy to engage in a self-paced and self-directed way
- **Critiques**, where the group collectively reflects on its experiences
- **Exhibitions**, where work is shared with peers and the wider community

Multiliteracies: Fostering Bi/Multilingual Education

What are Multiliteracies?

Children learn to speak, think, read, and write within their own cultural contexts at home and school.[123] Multiliteracies as pedagogy start from the assumption that language cannot be disentangled from its diverse so-

cial functions. Therefore, this approach challenges the widespread conception of literacy as basic reading and writing skills to highlight the importance of including issues of equity, support students' self-respect,[124] and incorporate today's multimodal practices such as social media and visual languages.[125]

In calling attention to the importance of multiculturality,[126] multiliteracies as pedagogy can be especially powerful for those learning a second language, because this approach offers students authentic communication practices to reflect on and recreate their multilingual and multicultural identities.[127]

Mother-tongue and bi/multilingual education have been repeatedly identified as among the most effective practices in developing countries and in the education of diverse communities.[128] Our illustrative approach for the pedagogy of multiliteracies are **bi/multilingual education**. Figure 2.6 illustrates the pedagogical continuum for multiliteracies.

Figure 2.6

Multiliteracies on the Pedagogical Continuum
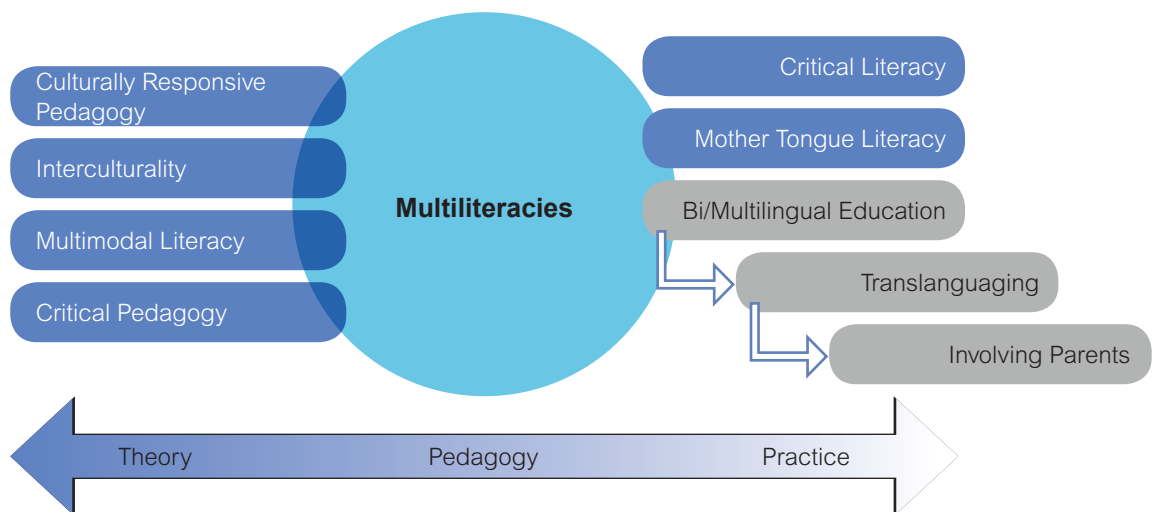
Source: Based on Paniagua and Istance (2018, p. 38).

Note: The theoretical models and discrete practices are illustrative examples, not exhaustive categories.

How Bi/Multilingual Education is Important for Leapfrogging

Zhang et al.'s review highlights that multiliteracies are inextricably linked with identity, the construction of self to position oneself in the world, and civic pluralism.[129] Multiliteracies increase learners' cognitive engagement and agency in literacy practices. This engagement in the classroom is important for students to be competent contributors to the activities, and to feel engaged as members of the classroom community.[130] Through their active participation as competent users of their language, students can develop critical awareness of how literacy practices are constructed and empowers learners to creatively draw on their own funds of knowledge when negotiating the meaning of texts and other sources (box 2.8).

Bi/multilingual education can serve to revitalize indigenous languages and literacy, as well as to counteract deficit approaches to those languages used by minority groups (box 2.9).[131] Underbuilding on the critical literacy approach, bi/multilingual education deepens into the wider "literacy ecology" of communities that are not always recognized by teachers and schools, and the ways that language is related to inequitable access to social, economic, and political power.[132] Therefore, the teaching of literacy aims at raising cultural awareness of the working class, cultural minorities, and indigenous communities to participate in the transformation of their local contexts.[133]

The reinforcement of mother-tongue instruction both in schools and at home is consistently identified as having a positive impact on both languages.[134]

Box 2.8: Perspectives for a Diverse America: Teaching for Tolerance

The **Perspectives for a Diverse America** program is based on the improvement of literacy skills through the reduction of prejudice and increasing the appreciation of diversity. Created and made available in 2014 by the Southern Poverty Law Center in the United States, the program offers literacy instruction through a web-based anthology of texts, strategies, and tasks for K-12 teachers. The curriculum is not scripted and teachers choose the materials they think best fit the needs of their classroom. Topics include race and ethnicity, gender, sexual orientation, class, immigration, religion, disability, and bullying. The program echoes the core objectives of multiliteracies, from considering different text types (literature, informational, visual, and multimedia texts) to promoting an active and critical engagement with literacy skills.

The instructional plan consists of a mix of instructional strategies and assessment tasks. In the "word work" phase, for instance, students increase their ability to comprehend and produce language by using key vocabulary from the central text in their own reading, writing, speaking, and listening. "Community inquiry" is designed to foster the capacity of speaking and listening by engaging in meaningful conversations about the text, while in "do something," students demonstrate anti-bias awareness in everyday behavior or with coordinated social action.

In an evaluation of the program, teachers reported substantial classroom effects in five areas: literacy development, student engagement, empathy, classroom climate, and student behavior. Every teacher used at least one strategy or task to assess their students' academic skills and found them improved. Students engaged profoundly with texts and tasks, sometimes surprising even veteran teachers, connecting with their classmates and current events and bringing their learning into the community.

Source: Shuster (2015).

Box 2.9: Bilingual Education in Peru: "Translanguaging" Quechua

In the southern region of Peru where Quechua is spoken, intercultural bilingual education historically has been restricted to rural areas. However, Quechua is now becoming part of a new language policy that promotes its use and visibility. The teaching of Quechua is still viewed in a traditional way, in which teaching methods focus on grammar and look at bilinguals as "two perfect" monolinguals, promoting purist perspectives that sanction linguistic transference, borrowing, and code switching.

Since in many urban settings where Quechua is taught, classrooms are racially/linguistically segregated and Quechua-speaking children with rural backgrounds often lack a legitimate voice, teaching Quechua becomes something more than simply teaching literacy. Teachers need to address issues of recognition and belonging and of accommodating literacy teaching to students' abilities and realities in both languages. Some teachers seek to incorporate this in their classrooms through the methodology of **translanguaging**, which encourages students to think critically about language, mixes languages to enhance communication, and encourages children to enjoy interaction with the language, rather than feeling insecure or ashamed when speaking it.

Translanguaging is thus a bi/multilingual approach that encourages all students to participate in the classroom and alters the extent of language mixing, depending on students' abilities. The approach promotes talk as a cooperative strategy to transform unequal power relationships in the classroom, to empower those who are more proficient in Quechua, and also to bring to the fore urban children as potential Quechua speakers. Using translanguaging as a flexible instructional strategy to negotiate bilingual identities, the teacher increases inclusion, motivation, and skills in a safe learning environment of mutual respect and, notably, bridges the gap between traditional institutional norms and the lived multilingual reality of students.

Source: Zavala (2015).

UNESCO emphasizes that children learn best in their mother tongue as a prelude and complement to bilingual and multilingual education, and that mother-tongue-based bi/multilingual programs improve academic outcomes, as well as self-confidence and cultural pride.[135]

Implementing Bi/Multilingual Education in Schools

Outstanding challenges to multiliteracies pedagogy include the persistence of traditional literacy practices that focus mainly on writing and reading, lack of professional training, inadequate materials, and tensions with standardized literacy tests.[136] Wearmouth points to the "dialogic space" needed so that learners can engage in fruitful discussion with teachers and peers, which is essential for literacy acquisition.[137] Effective dialogic teaching involves teachers and students addressing tasks together, listening to each other, and considering alternative viewpoints; allowing students to articulate ideas without fear of being wrong and to offer each other mutual support; and designing learning toward particular goals, with dialogic teaching in mind.

The pedagogical components of bi/multilingual education are commonly organized around four processes:

• **Experiencing**, which starts with immersing learners in a wealth of texts and resources, with teachers providing bridges across different domains. This harnesses the richness of knowledge in local communities and offers entry points into the often standardized, rigid school curriculum.

- **Conceptualizing**, with teachers guiding learners' attention to various elements of language and other semiotic systems.
- **Analyzing**, in which learners reflect on their own and other people's perspectives, interests, and motives, including power dynamics and ideological constructs.
- **Applying**, in which learners apply appropriately and creatively what they have learned to new situations. [138]

Zhang et al. elaborate on the idea of "pedagogical weavings" to capture the nonlinearity of this cycle. The cycle is iterative as students make connections between formal and informal settings, and between acquired knowledge and new texts and experiences.[139] The role of parents as first teachers and in supporting the mother tongue at home is also underscored by UNESCO in the acquisition of linguistic competence in children.[140] Hence, strategic partnerships between schools and families for literacy should be part of bi/multilingual designs.

Gamification: Storytelling to Immerse Students in the Flow of Learning

What is Gamification?

Gamification describes the different ways in which the pedagogical architecture of games can be transferred to formal learning settings, while still maintaining the element of play.[141] Gamification goes beyond game designing and seeks to capture the underlying benefits of game mechanics to immerse students in learning. This blurs the lines between ability, motivation, and enjoyment to encourage students to go beyond the expected requirements of the activity.[142] Parker and Thomsen have identified the positive impact of playful learning environments on a wide range of social, cognitive, and emotional skills;[143] with gamification, this means to foster inclusion, experimentation, and immersion.[144] Learners achieve a "state of flow," in which

The "Flow State" as a Fundamental Pedagogical Goal
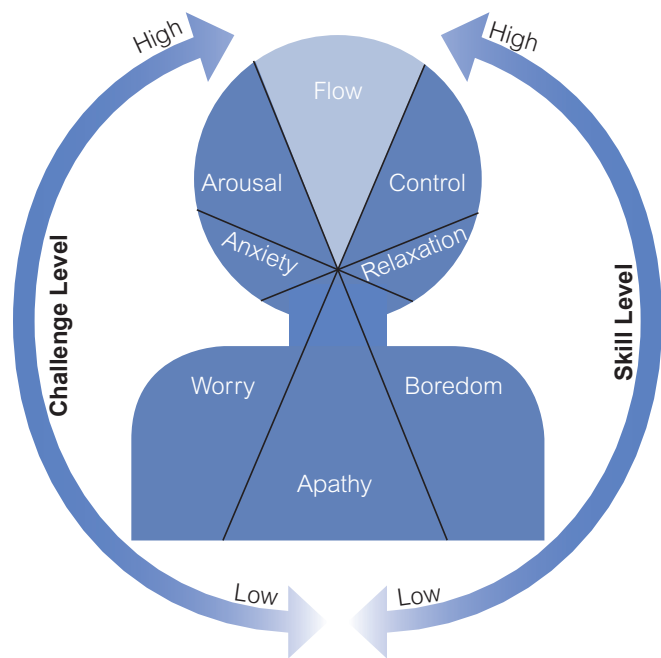
Source: Based on Csikszentmihalyi (1990).

they are totally focused on the task and feeling neither too bored, relaxed, anxious, nor thrilled (figure 2.8).[145]

Quite often, gamification is linked to technology such as digital games and virtual environments, and to gaming mechanisms—badges, goals, challenges, levels, etc.—and how to integrate curriculum content into these. We focus on the other two components of gamification: aesthetics and story. These are the sensations and narratives that create the level of immersion that the player (student) experiences in the game (learning).[146] **Storytelling** is critical to situate the learning, helping players create a mental model of an entire process and maintain their attention as they want to know what happens next. Through storytelling, teachers can engage with the emotional side of cognition and advance proficiency in oral expression and comprehension, for good stories demonstrate actions and consequences, thereby setting the scene to

Gamification on the Pedagogical Continuum
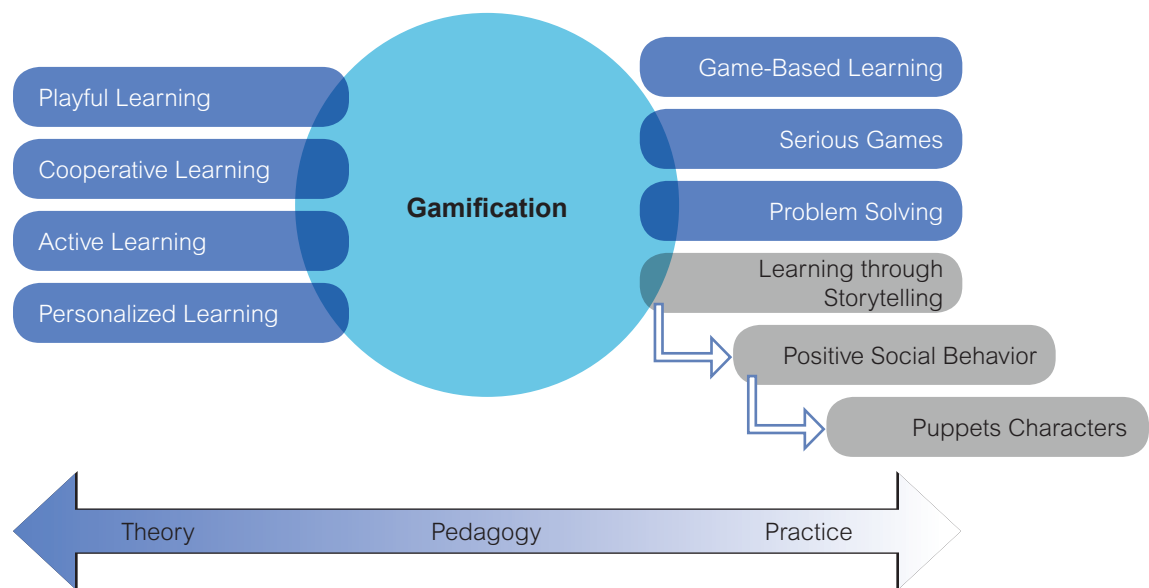
Source: Based on Paniagua and Istance (2018, p. 38).

Note: The theoretical models and discrete practices are illustrative examples, not exhaustive categories.

encourage the audience to do something. Figure 2.8 illustrates the pedagogical continuum for gamification.

How Storytelling Is Important for Leapfrogging

With storytelling, story elements are added to a course or the course starts with a challenge instead of a list of objectives; storytelling does not create an entire game but adds game elements to the teaching. Storytelling represents a next step for many schools and teachers if it is used instead of whole-class teaching, lectures, and traditional drilling. The storytelling elements of gamification broaden the range of pedagogical practices related to teacher talk; they revalue proficiency in oral expression and comprehension as a fundamental pedagogical tool. Teacher chalk and talk can be enriched to become appealing storytelling with dialogue and discussion, closed questioning and telling, and greater cognitive engagement.[147]

Research has found that gamification enhances engagement and motivation, social relations and satisfaction. It also achieves the following:

- reinforces positive attitudes toward learning
- helps retention and self-constructed learning
- actively engages students in critical thinking
- promotes learning engagement
- develops social and cognitive skills[148]

Digital games per se do not necessarily promote learning achievement, which rather is shaped by the particular design elements and how objectives are targeted for specific learning content.[149] As discussed by Agosto, storytelling can be so powerful that students can enter a trance-like state when deeply listening.[150] Storytelling can build community among students and teachers, enhance memory recall, support early literacy development, and promote creative thinking.

Box 2.10: Storytelling to Improve Mathematics Teaching in Greece

Storytelling in mathematics can spark the interest of students, reduce their anxiety, engage them, and enable alternative explanations of a mathematical idea or principle. Fractions are among the most complex and important mathematical concepts in elementary school, and difficulties arise in part through weak instructional designs that focus more on memorizing procedures than on understanding.

This research project observed teachers introducing a new mathematical concept to a group by reading a designed story to students while displaying the pictures accompanying the text. Next, there was a brief discussion about the content of the story in the classroom, while the students worked on mathematics activities related to the story and learning objectives. Students were encouraged to interact strategically and purposefully with both the teacher and the content of the story. This required students to be active participants rather than passive listeners.

After four sessions of 45 minutes each over four weeks, the group of students that followed this new approach showed a greater increase than the control group in those skills that require greater abstract conceptualization and problem-solving. This positive impact was not significant for the high-achieving students, but it was very clear in medium- and low-achieving students. Storytelling provided them with a meaningful context and structure to remember what they learned and to incorporate new knowledge. By learning mathematical concepts through the development of the story, students understood "how a fraction behaves," and also displayed better knowledge transfer in solving new problems with similar content.

Source: Lemonidis and Kaiafa (2019).

Implementing Storytelling in Schools

All curricular topics from history to science can take the form of a story, allowing teachers to present lessons as narratives and to exploit the engagement and motivational power of compelling stories.[151] Although storytelling can obviously develop literacy skills, our focus here is on storytelling and elements of gamification to enhance narrative skills in any subject—in accordance with the view that storytelling is a cornerstone of literacy development.[152] Thus, storytelling can structure gamification by building an attractive narrative around the content, to motivate learners to engage with the process of learning (box 2.10).[153]

Botturi, Bramani, and Corbino suggest that storytelling requires multiple skills, from understanding structures for writing a story, to being able to give stories shape—verbally, visually, and aurally, with different media.[154] They propose that during teacher training, the educator students should go through the same process of storytelling that they will implement later on with children: writing stories, creating storyboards, and illustrating, using supportive media if needed. Teachers need to be proficient in the key concepts of storytelling and be able to reflect on the elements of a story structure (events, character roles, etc.).

Agosto underlines the importance of asking follow-up questions and building personal connections to help children relate stories to their own perspectives, experiences, and expectations.[155] If successful, storytelling may enable a more natural, playful way of learning, as illustrated in box 2.11.

Implementing Innovative Pedagogies: Moving Beyond Classroom Walls

Leapfrogging in education is an ambitious and challenging goal that cannot be achieved solely by better

Box. 2.11: Papilio: Storytelling, Puppets, and Play to Foster Social and Emotional skills in Preschool Children

Storytelling is central in many kindergarten programs to teach new skills to children. **The Papilio program** was developed in Germany to develop social-emotional competence and socially responsible behavior in children aged 3-7; now it has been adapted in kindergartens all over the world. The methodology is essentially based on sparking children's imagination and interest by means including storytelling, songs, and puppet characters.

Under the program, preschool teachers implement education procedures aimed at promoting children's social-emotional competence, group-orientation and pro-social behavior, and integration into their peer group. For example, in the intervention "Paula and the pixies in the box," four pixies, each representing one of the basic emotions—sadness, anger, fear, or happiness—are introduced through an interactive story. With the help of the story, the children learn how to recognize basic emotions by interpreting gestures, facial expressions, and bodily reactions, and then learn how to control and to communicate those emotions. Additional supporting materials include pictures of the pixies' faces, a compact disc with recordings of the pixies' voices and songs referring to feelings. The children are also encouraged to empathize with each other's feelings and to provide help.

Papilio teachers regularly use three techniques: (1) teaching sequences, for example, directed toward recognition of emotions represented by specific hand puppets; (2) putting away toys once a week to promote interactive activities between children; and (3) a version of the Good Behavior Game—which fosters good behaviors by rewarding student teams for complying with criteria set for appropriate behavior. This shifts from a predictable and visible procedure with immediate rewards, to one with less predictable occurrences and locations, using deferred rewards.

Early childhood educators have noticed that the Papilio children speak more about their emotions, are more empathetic to other people's feelings, and get along better with others in play. That is because the program has shown them effective ways to understand their own and other peoples' emotional behaviors. A randomized controlled trial that evaluated Papilio showed that in comparison with the control group, the intervention group children showed a greater decline in overall problem behavior, a greater increase in positive social behavior, and better social-emotional skills as rated by their teachers. These positive changes were observed not only four months after the start of the program, but also continued until the end of the one-year intervention period. Papilio also showed positive effects for the teachers: teachers reported less stress and higher self-efficacy and job satisfaction.

Source: Papilio; von Klitzing (2011).

conceptualizations and awareness of examples of innovative pedagogies. The pedagogical approaches discussed here can help develop the knowledge needed to implement theories and learning goals—what Desforges and Abouchaar refer as "educational engineering." However, we need to look out beyond classroom walls and formulate policies about teacher standards, initial teacher preparation systems, teacher leadership, how resources are allocated in schools, and ultimately, how school models are designed to link learning experiences that take place inside and outside of classroom walls.[156] Aligning these pedagogies through teaching standards and teacher education content is not easy, but this report in short gives policy

tools to stimulate the necessary dialogue within education systems and coordinate efforts to meet overall learning goals.[157]

Most teachers' practices, innovative or not, are located on a continuum of different axes that include the degree of student agency, the relative focus on skills or content, the degree of discovery in the design, and how teachers recognize learner experiences. Teaching approaches do not fit into the sharp dichotomy of teacher-centered versus student-centered. The orchestration of teaching and learning is a combination of different techniques, philosophies, and tools.[158] Trying new pedagogical approaches is not all-or-nothing, but involves sporadic episodes, specific activities or projects, and sometimes the comprehensive re-elaboration of whole subjects.[159]

Since there is far more global convergence in policies than in practices, general reforms tend to approach the classroom as a black box. Teaching is simplified to the promotion of individual learning and development to improve technical efficiency, with teachers viewed as technicians or civil servants.[160] But to become a good teacher, a person must be a sensitive, creative, and skilled professional, who approaches learning as personal and intimate.[161]

Faced by back-to-basics content-centered reforms and a lack of conceptualization about pedagogy, teachers often engage in contradictory practices, as they constantly negotiate their own educational ideals within local and national realities.[162] But teachers are not alone within these contradictions. According to Winthrop et al., only 11 of 100 countries have evidence about the effects of initiatives to develop actions that broaden students' range of skills—regardless of the widespread stated interest in this matter.[163]

Essential to the implementation of innovative pedagogies is an approach that combines the culturally and nationally unique with general theories of classroom

Teaching Innovation Requires Moving Beyond the Classroom Walls
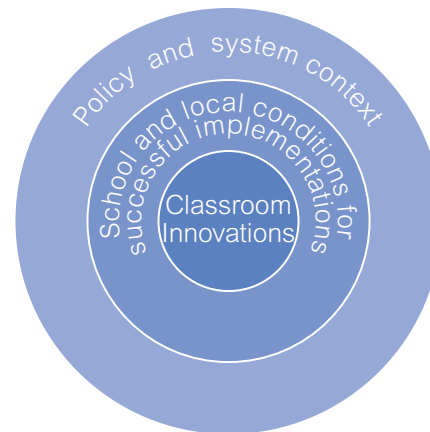
Source: Based on Tickly and Milligan (2017).

Note: School and local conditions include the existence of a supportive infrastructure, including the capacity of human resources, Continuous Professional Development, and the engagement of stakeholders. Policy and system context refers to existing policy priorities and the way that innovations address curriculum goals.

pedagogy, and recognizes that teachers' reflective interpretation is needed to make pedagogical approaches more context-appropriate.[164] Policies need to be framed at multiple levels, which include teachers' personal inclinations and skills, local conditions for implementing new teaching approaches, and the wider national context of curriculum and policy priorities.[165] Such a multilevel approach is captured graphically in figure 2.9.

Ultimately, serious implementation of these six clusters of innovative pedagogies implies not just reform of systems, but also deep change and transformation of systems. There are important enablers of such transformation that must happen outside the classroom, both in how to prepare and support teachers, and also in the design features of schools, including widening the profile of educators and more systematically linking in-school and out-of-school learning experiences. It is these enablers that we turn to in the next section.

Three Structural Changes Are Needed for Innovative Pedagogies to Flourish

For innovative pedagogies to truly take root in education, there must be a range of conditions present outside of the changes any given teacher can make inside their classroom. These necessary conditions range from policy directions set by leaders of education jurisdictions, to parent and student demand for new forms of learning. In this report, we focus on three structural changes within education systems with strong potential to encourage the successful uptake of innovative pedagogies across the six clusters. These include: (1) investing in teacher professional development to ensure the foundations of quality teaching; (2) widening the profile of educators; and (3) supporting new school models that use arrangements that are hybrids between formal and nonformal learning. We chose these three both because they can provide foundational support for innovating teaching and learning experiences to flourish, and also because they emerged across geographies from the examples of innovation we examined. We will review each in this section, providing a range of examples illustrating how these changes could be put into in practice.

Investing in the Foundations of Quality Teaching

Quality teaching is fundamental for improving learning outcomes, whether in core skills and literacies or in the broader suites of competencies that characterize 21st century curricula. "Perhaps the clearest finding is that having a fully functioning school…with teachers that show up for work and with greater knowledge of the subjects they teach…appears to be the most consistent (input) conducive to student learning."[166] This foundational truth is echoed in the Education Commission's recent review of literature on the teacher workforce: "High talent teachers remain critical to the education endeavour of improvement in student learning outcomes; in all contexts the student–teacher relationship is central to quality learning experiences."[167]

We saw in Section 2 that teachers are critical to innovative pedagogies. This gives the lie to any simplistic idea that students are somehow left to their own devices in teaching strategies, though the frequency of terms such as "teacher as facilitator" and "the guide on the side" may encourage this misunderstanding. There has even been the suggestion that teaching strategies characterized as "teacher as activator" exercise a more powerful influence on learning outcomes than "teacher as facilitator."[168] Therefore, teachers' own learning must be a central plank of the ambition to leapfrog—growing the capacity and skills within the systems of education and of broader learning.

It is essential that education systems prioritize teacher development and support to ensure quality teaching, determined by the foundational dimensions of teacher

professionalism. At the core of teacher professionalism are pedagogical accomplishment and expertise.[169] Considering the extensive literature on teaching, education, and learning in academic and policy reports, some of which we included in this report, we suggest that the foundations of quality of teaching (figure 3.1) depend on baselines of the following:

- Pedagogical knowledge of theories and practice
- Content knowledge, including pedagogical content knowledge
- Teaching across the range of children and not only focusing on the top achievers
- Time for teaching, with at least 70 percent of classroom time devoted to instruction

Figure 3.1

Foundations for Quality Teaching

- Pedagogical Knowledge
- Content Knowledge
- Teaching to All Children in Class
- 70% Classroom Time for Teaching
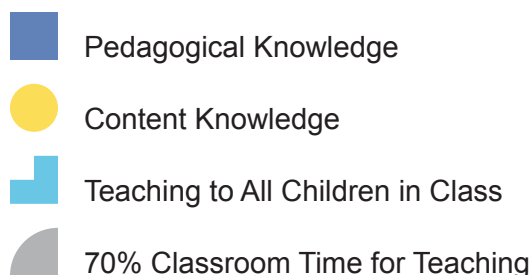
Professionalism for teachers requires the complex capacities of collaboration, critical reflection, adaptation, and self-directedness. But first, teachers need the basic competencies of actionable pedagogical and content knowledge.[170] Without a minimum of professional competencies and supports, teachers are unable to translate pedagogical interventions into classroom practices to positively impact students' learning.

The introduction of innovative pedagogies does not require a certain threshold of quality teaching. That would suppose a causal relationship between teacher competencies, experience, and innovative skills. But experience with innovative pedagogies does bolster quality teaching. Teachers need to be exposed as early as possible in their careers to environments and professional experiences permeated with teaching innovation.[171] Innovation strengthens their pedagogical knowledge and broadens the resources they bring to bear to address diversity of classroom needs.

Innovative pedagogies, however, do not guarantee quality teaching. Content knowledge and teaching time depend on other factors, including institutional arrangements, teacher preparation, and classroom management. Just as exposure to innovative pedagogies can help lay the foundations for quality teaching, so too can such teaching provide a platform to introduce innovative pedagogies by developing the more complex capacities and participation in peer networks that are needed for the innovation to work.[172]

Global Gaps in Quality Teaching

Unfortunately, quality teaching competence and support is often lacking in education systems across the world. In many countries, expanding school systems have difficulties finding sufficient trained teachers, and large numbers of unqualified adults enter the teaching profession.[173] The percentage of trained teachers on the job in primary and secondary schools has dropped since the beginning of this century in a number of the world's most highly populated regions (figure 3.2). In sub-Saharan Africa, the drop is especially acute where the percentage of trained teachers in primary and secondary schools is down from 85 percent in 2000 to 50 percent in 2015. The UNESCO Institute of Statistics lists 32 countries where fewer than 75 percent of teachers have appropriate qualifications. In Africa overall, a third of classrooms are "orphaned," with high proportions of teachers lacking knowledge of the subjects they teach.[174] The situation in Latin America and the Caribbean is similarly problematic.[175]

Figure 3.2

Trained Teachers, by Level of Schooling and World Region
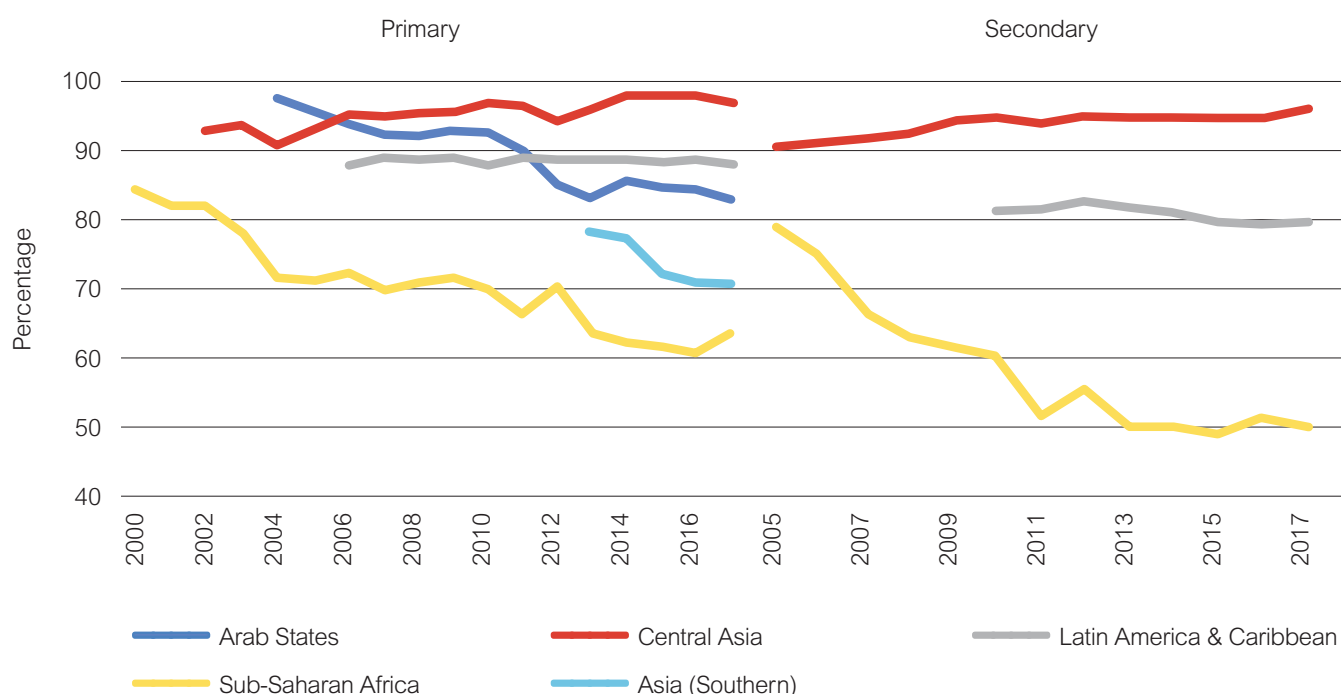
Source: UNESCO Institute of Statistics (2018).

Note: The UNESCO Institute of Statistics defines percentage of trained teachers as percentage of teachers by level of education taught who have received at least the minimum organized pedagogical teacher training, pre-service and in-service, required for teaching at the relevant level in a given country.

The lack of trained teachers plagues educational systems not only in the developing world, but also in under-resourced regions of North America and Europe. In the United States, school systems across the country are struggling to address teacher shortages, often resorting to underprepared teachers who leave far more frequently than those who are well-prepared. Most often, these underprepared teachers are hired in schools serving students of color and from low-income families.[176]

Additionally, teacher professional development in many locations lacks quality and coherence. According to the OECD, "In most countries, teacher education continues to be largely a fragmented experience for most teachers."[177] In the developing world in particular, only a lower secondary education is required to gain entrance into teacher education institutions.[178] Once admitted, teacher trainees encounter programs that lack sufficient length and quality to prepare them to employ a diverse range of approaches to teaching and learning.[179] Typically, classes consist mainly of lectures, giving prospective teachers little opportunity to connect theory with classroom practice. In Tanzania, for example, linking what a teacher learned in college to the application of this knowledge in the classroom is the exception rather than the rule.[180]

Teacher training is problematic even in developed OECD countries, where there is often a reluctance to

bring pedagogy to the fore of public policy debates. In addition, concepts of teacher professionalism are often highly individualistic and expressed in terms of the knowledge and capabilities of individual teachers, whereas teacher professionalism actually depends on collaborative learning, design, and networking with "teachers as designers of learning environments."[181]

Innovative Approaches to Developing the Foundations of Quality Teaching

To ensure the implementation of innovative pedagogies and to develop quality teaching across the six clusters, serious investment and commitment will be needed. That will require systemic prioritization of teacher learning and support, strong partnerships between stakeholders (universities, schools, and policymakers) and mechanisms for collaboration among institutions.[182] Networks for knowledge sharing, skills development and reflection among schools can help both at the system level (building capacity) and at the school level (spreading good practices and reflection across teacher communities).[183] Structured pedagogy programs—typically combining the development of new content and materials with training of teachers in delivering the content—have shown the greatest positive effects on teacher candidate learning.[184] In contexts where pre-service teacher education is severely lacking, training that provides detailed guidance on what and how teachers should teach has proven essential for raising the skills of low-performing students.[185] Teacher self-efficacy is a significant moderator of teachers' beliefs in their performance, because educational programs rely heavily on the strength of teachers' perceptions. When teachers are well motivated and enthusiastic, their commitment to the teaching profession improves. The observation of successful teaching, with demonstration of skills, can convince teachers to expect similar outcomes and give them the emotional and psychological support for self-efficacy.[186]

Teacher learning should be conceptualized as a continuum, with initial teacher preparation as the beginning phase of professional development and membership in the wider education community.[187] This initial preparation should harness inquiry and reflection on practice as the main learning strategy, and should leverage networks of diverse sources, which can be vitally important supports that allow teachers to fulfill their potential as professionals. McAleavy et al. remind us that approaches such as short, intensive periods of residential training, vacation workshops, complementary distance learning, and local cluster groups are characteristic of high-impact professional development initiatives across all sectors, not just education.[188] However, "while peer support and learning is a fundamental ingredient of effective continuous professional development, it is not sufficient in its own right and [can] lead to overly introverted models that recycle existing practice, if teachers are not also given structured and facilitated opportunities to engage with new evidence, theory, and practice."[189]

Several education innovation programs we reviewed demonstrated a commitment to developing basic quality teaching. Across diverse geographic settings, such programs are experimenting with new ways to support teacher learning. Innovation in teacher learning and support may take two forms: (1) new ways of providing teacher education, such as the "observation tool" developed by Chile's Un Buen Comienzo (A Good Start) program, or the development of locally available teaching resources, as demonstrated by the Fabretto program in Nicaragua; and (2) embedding new methodologies, such as Montessori or Enseñaza Abierta (open education), or the development of 21st century literacies.

In these examples, the work takes place with practicing teachers in different levels of education, from early childhood through high school. The training is not meant to replace initial teacher education, but rather to build on it.

- **Un Buen Comienzo** is a teacher professional development project in Chile designed to improve the quality of early childhood education. It helps schools improve the teaching practices of classroom teams, taking a whole-school approach and working with each school over a two-year period. It includes coaching—using an observation tool that assesses interactions between teachers and students—as well as collaborative work between participating schools. The project includes monthly coaching sessions for teachers, teachers' assistants, and school leadership teams.[190]

- The **Ayrton Senna Institute** is a Brazilian NGO supporting the public education system through curricular and pedagogical transformation, extracurricular offerings, teacher training, and research on education innovations. At the primary level, it is utilized with whole-child plus extended-day projects. It also offers flexible, part-time and before and after-school learning models at the high school level, and a programming literacy program at the upper-primary level that trains teachers and community members to serve as extracurricular coding teachers.[191]

- The **Fabretto Children's Foundation** trains public school teachers in Nicaragua and provides key resources for classrooms. Training focuses on hands-on, play-based learning strategies inspired by established innovative methodologies (such as Montessori and Enseñaza Abierta) and adapted to rural Nicaragua. Teachers also learn to create teaching resources from locally available supplies.[192]

- **Jambo Bukoba**, a sports and life skills program in Tanzania, uses trained teachers as "multipliers" to other communities by addressing the problem of school dropouts, the quality of learning, parental and community participation in education, and gender equality. Teachers are trained through specialized workshops, professional manuals, and sport materials. The government provides advocacy to promote widespread adoption, increased educa-

tion ministry support for teachers, and funding.

- **Right to Play**, a global NGO, has developed a play-based methodology for use in teacher education programs. In Tanzania, the organization has partnered with the Tanzania Institute of Education to train pre-primary teachers. Results from program evaluations and monitoring reports show a reduction in corporal punishment among teachers trained in the methodology, increased use of child-friendly and play-based teaching methods, greater inclusion of girls in pre-primary education, enhanced life skills, and increased attendance and achievement of children in school.[193]

Harnessing the Potential of Technology, Online and Offline, to Develop Quality Teaching

With its practicality, specificity, and continuity, technology has enormous potential to enhance teacher professional development. Teacher learning can be made practical, for example, with cost-effective videos demonstrating promising practices in authentic settings.[194] Mobile phones and open educational resources may significantly improve the quality of professional development in developing countries. Moon calls for a radical review of existing policy trends to:

- Expand initial teacher training through scaled-up outreach and digitally supported programs
- Develop similar strategies to give unqualified and under-qualified teachers support to achieve proper qualifications
- Prioritize the development of new structures of scaled-up, digitally supported, local and school-based professional development, with a strong focus on the effective teaching of core literacy and numeracy skills[195]

The role and potential of technology feature prominently in the teacher professional development examples in our Catalog of innovations. This may take the form of courses delivered online rather than in

traditional face-to-face formats, in the online delivery of teaching materials to back up teacher learning, or in the creation of online professional communities. Among these are:

- **Bootstrap**, based in the United States, which integrates math and computing education for students in grades 6-12, by providing classroom materials (curriculum and software), professional development programs, and teacher support. Bootstrap convenes teachers for peer learning and professional development workshops and provides an online community hub for educators and volunteers to share their knowledge.[196]
- **The C-STEM Challenge**, a program that operates in several countries (the Dominican Republic, South Africa, and the United States). It builds on best practices in STEM education, as well as earlier research and development that provide theoretical and empirical justification for student and teacher engagement in C-STEM programs. A key strength of the project is its online training courses for teachers and students in communications, science, technology, engineering, and mathematics.

Technology is not the only critical medium for teacher training. The learning itself may be about digital knowledge and skills. For instance, the **Atlas of Diversity** program in Spain, identified teachers as the key to success, then began equipping them with the technological know-how to adopt new ways of teaching.[198] The courses are designed to persuade teachers to immediately apply their learning in the classroom and for the new methodologies to quickly reach students. The courses also create support networks among teachers, as they continue to learn from each other and stay up-to-date after the initial course has finished.

The role of technology in teacher learning is as relevant, if not more so, in less-resourced countries. The Iraqi refugee **Ilm-on-Wheels** program deploys a master teacher trainer in a virtual classroom from a remote location as the vehicle to deliver teacher education.[199] The **Mobile Taleem** project in Pakistan gives teachers access to 300 lessons via mobile phone and videos that can be viewed offline. This addresses the problem of content knowledge gaps among primary teachers, particularly in rural areas of Pakistan.[200] As the content is homegrown, it is more scalable and cost-effective.

Despite the many benefits of technology, it cannot be the only way to improve teacher training. Technology by itself has limitations as a mode of delivery in ensuring adult professional learning, and existing technology infrastructure is often weak in some countries, as we saw in Section 2. Face-to-face instruction and local contextualization of teaching will always be crucial for the education of both teachers and students.

In locations that are isolated and lack necessary infrastructure, solutions may not so much involve using technology to bring education to remote students, but rather in taking technology to them instead. The models used may be sophisticated and the mobile provision may apply technology in ways that are ingenious and fit-for-purpose, assuming that a digital connection is unavailable.

Seeds of Empowerment is one example. This global NGO grew out of Stanford University and is dedicated to educating and empowering the hard-to-reach with innovative mobile learning solutions.[201] Its pedagogies draw heavily on storytelling, which we featured prominently in Section 2. All Seeds of Empowerment mobile learning solutions were originally developed for remote, underserved areas, which lack reliable internet or electricity. One of its innovations, a battery-operated SMILE (Stanford Mobile Inquiry-based Learning Environment) Plug, provides a private classroom cloud-based tool that can be used on as many as 60 mobile devices at a time. It houses education resources and supports for all its mobile learning programs. Similarly, the **Shaishav** project in India uses a mobile learning van.[201] It partners with pre-primary and primary schools

to train local teachers and activists to bring out-of-school/working children back to school. The learning is child-centered and participatory, and uses games, videos, and television to deliver educational content.

Widening the Profile of Educators

Teachers able to deliver basic quality teaching provide an important platform for implementing innovative pedagogies, a platform which can be strengthened by expanding the profile of who is even considered to be an educator. This enabling condition requires a fundamental shift in the design of the education workforce itself. Within the global education community, this topic has received considerable attention in the last several years.

For example, a 2016 CUE report, "Millions Learning: Scaling up Quality Education in Developing Countries," identified creative leveraging of the time and expertise of community members by teachers and schools as important for scaling up initiatives that improve learning.[203] Subsequently, CUE's book "Leapfrogging Inequality" suggested that diversifying the people from and places where children can learn is an important strategy to support leapfrogging. "Learning Generation," a 2016 report from the Education Commission, provided comparisons to some features of the global health sector, where scaling up change in health outcomes was assisted in part by crowding in community health workers and other strategies for differentiating tasks within the medical workforce. The Commission's recent project, the Education Workforce Initiative, is conducting case studies and deliberating on how to translate these ideas into practice.[204]

There are several frequent arguments in favor of broadening the profile of who can actively participate in the teaching process. The first is that casting a broader net can help compensate for teacher shortages, especially in disadvantaged areas. Second, engaging other caring adults in the teaching and

learning process can lessen the burden on educators and help them focus on their teaching. For example, training community volunteers to tutor students lagging behind in reading can free up teacher time and effort best devoted to the broader class.

A third argument for widening the profile of educators, and perhaps the most important for supporting the uptake of innovative pedagogy, is that it provides a platform for trained teachers to diversify, deepen, and enrich students' learning. As we will see from the illustrative examples discussed below, many pedagogies featured in the six clusters depend on the expertise and experiences of a diverse set of actors in and outside the classroom. Re-imagining the education workforce to include a wide array of people in a school's community, from professionals to parents to college students to peers, can more readily enable the types of pedagogical transformations that can help leapfrog learning.

Whether widening the profile of educators takes the burden off teachers and helps them focus on their craft very much depends on the type of role community members play. In many cases it is possible their involvement will raise the burden on teachers by necessitating supervision, direction, more sophisticated lesson planning and the like.

Diverse Profiles of 'Nonteacher' Educators

Many of the innovations we reviewed incorporated "nonteacher" educators, a feature shared across geographies. Depending on the innovations, this included a range of additional sources of support, in different contexts, for different purposes. As shown in figure 3.3, some of the ways in which innovations harnessed the contributions of nonteacher educators include:

- **Specialists and professionals** who come into classrooms to extend the range of professional expertise and experience

Figure 3.3

Widening the Profile of Educators
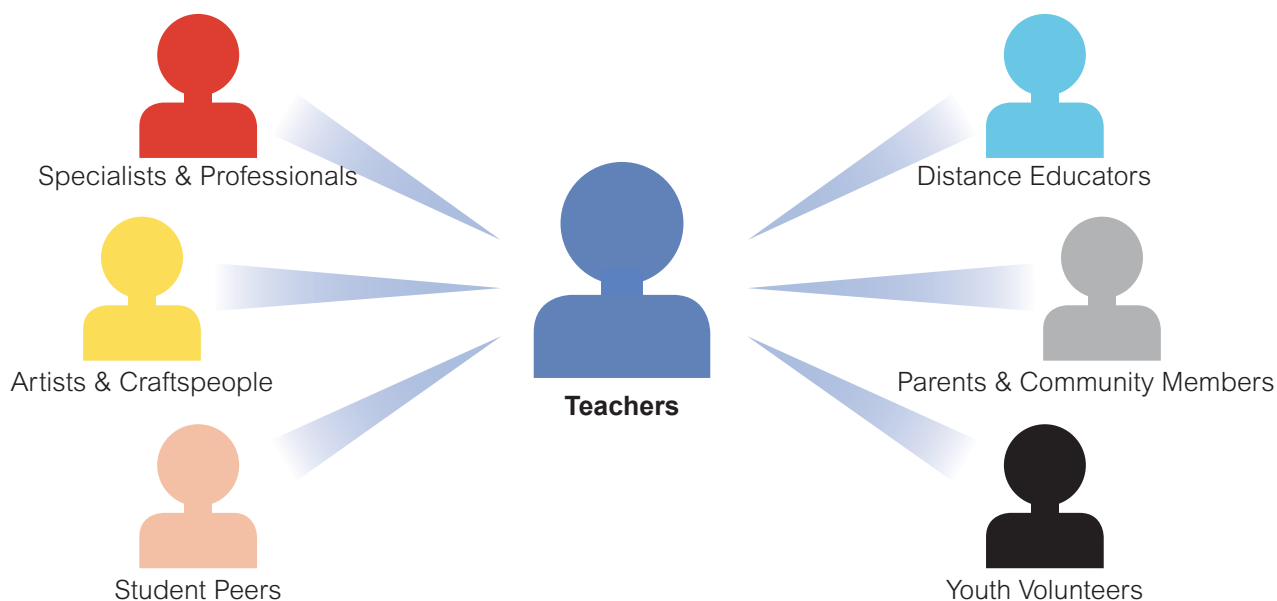
- **Craftspeople and other skilled adults** who tutor young people in service-learning programs outside school
- **Community members, parents, and teaching assistants** who act as much-needed auxiliary support in school and other settings, cementing closer ties between schools, families and communities
- **Youth volunteers**, frequently alumni of a secondary school or NGO program, who return to mentor students in a particular subject area
- **Peers** who teach their fellow students in group and mixed-age pedagogies
- **Distance education tutors** who may be qualified teachers but may also be program staff with different qualifications

Sharing examples where this is done in practice can help give color and texture to what widening the profile of educators can look like. Across many innovations, drawing on artistic expertise is a common example of the extended workforce. This is particularly true for schools seeking to emphasize arts in the curriculum, including those using embodied learning. Finding such expertise may be organized locally, or through the state education system.

In Australia, for example, **Bridgewater Primary School** has an Artist in Residence program that includes painting, crafts, sewing, mosaics, wood and metal work. Learning resources include a kitchen garden. Students also register their interest in specialist courses offered by adults, teachers, parents and external specialists.[205]

Other programs recruit and deploy creative professionals in schools in a more systematic way. **Creative Partnerships**, an international foundation, brings the arts into schools in the United Kingdom, Lithuania, Norway, Sweden, Germany, Czech Republic, Hungary, and Pakistan. Creative Partnerships works through partnerships between schools and creative professionals.[206]

One evaluation set out to identify key pedagogical characteristics of creative practitioners working with the program. It found that the program helped:

> …children and young people to choose to act in ways which allow them to gain a new embodied understanding of who they were, what they could do now, and what they might do in the future. This kind of learning was profoundly social and highly dependent on the ways in which creative practitioners and teachers came together to produce temporary and fragile space/times within school where it was possible to be/do/know/live together differently.[207]

The innovations we reviewed also offer examples where expert mentors are brought in, both to raise the quality of education and to extend the breadth of skills in the curriculum. That fits with models of project work and associated 21st century pedagogies. While the identification of expert mentors and specialists can be done ad hoc, programs such as Educurious and Project SEED put this onto a more systematic footing.

Project SEED, a nonprofit mathematics summer program that brings in specialists to extend existing teacher knowledge, is aimed primarily at low-income students in schools across the United States and has shown moderate positive effects on achievement.[208] **Educurious** is a U.S. nonprofit that aims to support and inspire 21st century learning skills by putting students and teachers in touch with a network of experts who work with them on authentic projects and problems.[209]

The Kenya **Young Leaders** program, sponsored by the Global Education Fund, links high school students to alumni who provide academic support, advice, and leadership advice. Student camps are facilitated mainly by volunteers, in partnership with African Nazarene University.[210] The program benefits students, makes it simple to recruit volunteers and provides additional educational opportunities for alumni.

The **Learner Guide Program**, a project of the Campaign for Female Education (CAMFED), an international non-profit organization supporting the schooling of marginalized girls, has programs in Ghana, Malawi, Tanzania, Zambia, and Zimbabwe. It mobilizes a network of young female alumni, who serve as mentors, and offers teacher education, continuous professional development, and networking.[211] Guides with the program are sought after by governments actively recruiting in more female teachers in areas with teacher shortages. The program not only promotes better teaching, the mentors help students lead projects that improve their communities.

The extension of education into communities, a powerful ambition of many innovations, includes enlisting community members into schools and workshops. In many cases, volunteers are women, and the benefits accrue both to the volunteers and to the students. In the United States, **iMentor**, a New York City-based nonprofit organization founded in 1999 to build mentoring relationships to serve students from low-income communities, enlists experienced and caring adults from the community to play a targeted role in student development. Personalization and emotional connection between students and mentors is an integral part of the approach. The students are largely from minority backgrounds and positive outcomes have been tracked not only in achievements at school but to college enrolment and graduation.[212]

Many of the volunteers are adult family members, especially parents, of the students in the school or program. The parents have the greatest motivation to enrich the education available to their children, while at the same time strengthening the ties between schools and families to be so important in student achievement.[213]

Parents as Learners as Well as Educators

The presence of adults, especially family members, tends to have a positive effect on discipline and class management, because it models the importance of school learning. It also forges closer ties between parents and their children. Extending educator profiles can be especially important in situations of disadvantage and vulnerability, and technology may prove to be invaluable. **PowerMyLearning**, a national education nonprofit in the United States, for instance, looks to break deficit cycles in disadvantaged families by engaging low-income parents as their children's learning partners, connecting classroom learning with the home, and creating educational opportunities for the entire family. Refurbished computer equipment, educational software, and tailored web content are used to train parents and teachers in how to strengthen children's math and reading skills.[214]

Charting these different educator profiles contributes to understanding the complex educational settings of the 21st century, whether in or out of school. It also the first step in being able to systematically envision a teaching workforce that includes high quality teachers alongside professionals and adults with their own role to play.

Supporting Hybrid Learning Environments

The innovative pedagogy to ensure all young people become lifelong learners draws on not only a diversity of people but also of places. Across education innovations, the archetypal school classroom is only one setting for learning. Students engaged in service learning, for example, gain experience outside the classroom, in their neighborhoods. Teachers learn play-based teaching techniques not only inside teacher training institutes but also on community sports fields.

Extending the design and delivery of education beyond the organizations of the formal system allows for the creation of hybrid learning environments. Leveraging hybrid learning environments can be particularly helpful for supporting the implementation of innovative pedagogy. This is because there are limitations to what transforming education systems from the "inside" can accomplish. Reforming pedagogy, teaching, and learning in structures that remain untouched means that change has to grow within the parameters of a dominant academic model. Transformed practice around the different clusters of innovative pedagogy, on the other hand, requires a broader vision of what good learning looks like across a breadth of skills, as well as a broader canvass in which to operate.

Many education innovations we reviewed experiment with hybrid learning environments. Zitter and Hoeve have sought to clarify the concept of "hybrid learning environments." They refer to how "established educational practices are fundamentally changing their relationship with their environments," that "a core problem underlying [this] is the complex and problematic nature of the transition learners are required to make from education to the workplace" and that "learners are expected to integrate different types of knowledge, for example, formal knowledge, work process knowledge, and practical knowledge."[215] In many ways this trend mirrors the increasing complexity we see across society from rising interconnectedness and new forms of work.[216]

The creation and spread of hybrid learning environments are both a reality of our increasingly complex learning systems and a welcome source of potential dynamism and learning opportunity. However, with complexity comes the need for focus. As more players and settings are involved, decision-making becomes more diffuse and negotiated, and leadership more complex. Just as the need for focused human design becomes greater, the means to shape the creation of learning systems has become more open-ended.

Scaffolding is needed for these complex hybrid learning environments, especially to enable the organizational learning on which their success depends. Such scaffolding takes different forms, but often has emerged as model approaches, based on a particular theory of learning and mix of pedagogies consistent with that theory, sometimes with accompanying materials of knowledge, lessons, and professional development.

Figure 3.4

Hybrid Learning Environments
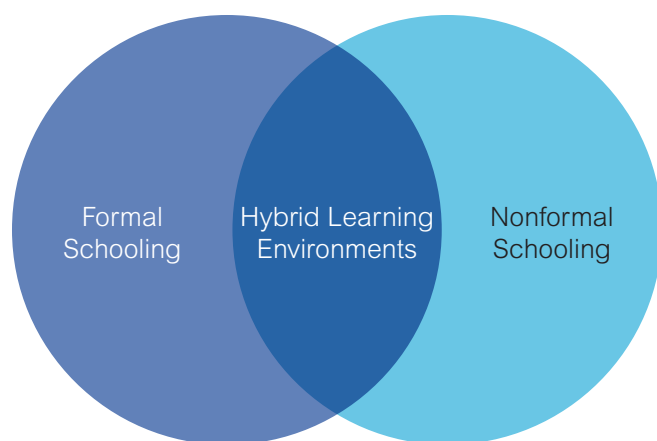
The main features of hybrid learning environments are found in diverse mixes of school and out-of-school programs and partners (figure 3.4). The hybridity may be at the level of the individual student, combining different elements into the total learning experience but not necessarily as part of a coherent overall design. The innovation itself might be the joining of previously separate partners, programs and sites, to become new, complex, and ambitious forms of educational provision. Some of the most interesting and powerful innovations are rooted in community partnerships, and some rely on technology to connect the different players and sites. The complexity calls for scaffolding, especially but not only in resource-poor environments.

We look at the scaffolding offered by explicit innovative models and the packages of materials and support to back them up.

The Community as a Resource and Location for Schooling

Life skills cannot all be nurtured within the closed and often artificial confines of school classrooms. But if not there, then where? The "community" is the answer identified by many innovations around the world. To integrate education more successfully into the community means also to modify or extend hours, allowing the school to fit with the cycles and timing of diverse organizations and families, rather than just follow its own timetables.

One example is the **Escola Municipal Professor Paulo Freire School** in Belo Horizonte, Brazil.[217] The school is open nine hours per day, extending the opportunities for learning to many more. On weekends the school functions as a social and cultural space for families, strengthening relational ties. **Kidogo**, an NGO in Kenya, is piloting a "hub-and-spoke" model to deliver early childhood care and education provision to families in urban slums. Its community "hub" centers offer safe and stimulating environments, trained caregivers, a health and nutrition program, and a play-based curriculum. Kidogo also works through "spokes" to deliver training, learning resources, and ongoing support to "mama-preneurs" running their own baby-care centers.[218]

Other educational programs are geared to meeting the learning challenges particular to students in isolated, rural communities. Through the **Ak'Tenamit Internship** Program in Guatemala, for instance, high school students in Mayan communities study rural community development or sustainable tourism, in both traditional and practical classrooms. The program is adapted to their culture and many languages. Its tutorial system makes education opportunities available in the most

remote, rural regions with participants gaining 1,000 annual hours of experience over three years in various work environments.[219] In Brazil, the **Maria de Socorro Rocha de Castro School** offers contextualized education in a rural area of Ouricuri, mixing informal and formal education, experiential learning and multiliteracies; family members and the community participate in school activities.[220]

These are examples of innovation in teaching and learning, often involving forms of service learning. They do more than just ensure access to education to remote populations. They emphasize student engagement with the community and the relevance of their studies. They are complex arrangements involving combinations of formal and nonformal, of theory and practice, of students and their families. They include debates and engaging pedagogies, including interdisciplinary teaching, not simply the transfer of information and knowledge. They contribute to the community but also to culture more broadly, recognizing and valuing indigenous knowledge. They are substantial learning experiences spanning many hours, not a fleeting learning episode.

As schooling broadens and diversifies into the community, learning will often take place in locations that were not originally intended for this purpose—which is the point of such diversification. The innovations cannot employ rigid educational designs. Each site and program must find its balance between specialist school learning facilities and authentic, real world learning environments. Hybrids might resolve this trade-off by allowing students to experience authentic community learning environments interspersed with specialist school arrangements. At the same time, they will need to avoid the worst of both worlds—poorly organized formal learning spaces and real-world environments where children may be at risk.

The innovative school-community programs described provide accessible relevant education where none

existed and strong benefits to learning. Furco charted the positive results of service learning, especially for motivation and engagement of students, critical in laying the foundations for lifetimes of learning, with positive but smaller impacts on conventional measures of academic learning. The benefits of service learning also spill over onto the community; Florijn found that students who participated in a service-learning program in Pakistan increased their commitment to contributing to the well-being of their societies.[221] Maeir et al. conclude that "well-implemented community schools lead to improvement in student and school outcomes and contribute to meeting the educational needs of low-achieving students in high poverty schools."[222]

Beyond the improvement in outcomes identified by Maeir and her colleagues, two other aspects of their conclusion stand out. First, they emphasize the important benefits for low-achieving students of bringing the educational experience closer to families and communities so fundamental for addressing inequities in education. Second, they stress that community schools or any other school model or pedagogy must be well implemented to realize their full potential. Haines et al. reviewed studies on successful family-school-community partnerships and found that school leadership focused on inclusivity and engagement of diverse families is an important condition for weaving the school into the fabric of the community, as is shared leadership with community members.[223]

These conclusions inform hybrid models in general. They need both to ensure that more complex learning arrangements do what they intend to do in extending learning opportunities to different groups and partners, and that they put in place the support and coordination mechanisms for both learners and professionals.

Schools as 'Core Social Centers'

Looking outward toward the community follows not only from ambitious broad skills curricula nor from the general finding that young people, as they mature, often get turned off by the childhood world of school. Both of these are powerful arguments. But the question can be turned around: What is it that the school can offer the community? As many traditional sources of community fragment around the globe, might the school be a source of cohesion and social capital? As described by Jacobson:

> What happens at a successful community school illustrates why they are an exemplar of schools as community hubs. In such schools, partners and providers deliver a wide range of services and supports at a central place—the school—and consequently the partners can serve many community members, not just students. In short, they engage families and communities as assets in the lives of their children and youth. Community schools offer enriching learning opportunities during the school day, after school, during the summer, and at other times. They provide social services and supports, such as health, mental health, adult education, and nutrition programs.[224]

This vision of school in community lays behind one of the scenarios created by the OECD to help shape the future of schooling.[225] These scenarios are alternative ideal-type system futures, aimed at innovators and policy shapers who can use them for big picture thinking—combining and rearranging, promoting those aspects that fit their positive visions of the future, while actively avoiding those they consider to be nightmares. The six scenarios covered the extremes of a status quo no-change and a catastrophe meltdown scenario, reschooling networking and pure market futures in which schools per se are less prominent, and two reschooling scenarios in which schools are strengthened, but with new purpose and social organization.

One of the reschooling scenarios (schools as focused knowledge organizations) resembles the ambition of many system reforms, but it is the other that is especially relevant to this section. It is entitled "the school as core social center." In this future, schools become the beating hearts within a nexus of several community organizations, each one strengthened by its partnership with the others.

Several of the innovations we reviewed exemplify core social centers in complex hybrid arrangements. **St Oliver's National School**, (Killarney, Ireland), for instance, is one of the largest and most diverse primary schools in Ireland. It is also a hub for the larger Killarney community. At different times throughout the year, the school is home to local health professionals, teachers from nearby secondary schools and community groups, as the school stays open until late every day of the week. There is a strong emphasis on learning through and about the environment, using outdoor pedagogies and the close community connections inevitably widen and embed the knowledge and skills acquired.[226] **Colegio San Luis Beltran** is located in a notoriously poor neighbourhood of Santiago, Chile. As well as embracing personalized pedagogies, the school also functions as the focal point of the community. Parents can take night classes there and look for jobs advertised on its bulletin boards, medical services are on-site and recreational activities take place at the school.[227] Other schools work closely with senior citizens homes or recreational facilities. They are more far-reaching when the integration permeates the educational life of the school, changing the sites for learning, the curriculum possibilities, as well as the concept of educator.

The following Cambodian example is complex educationally, too. The **Cambodian Children's Fund**, a 15-year-old nonprofit working with some of the most impoverished communities in Cambodia, combines residential and satellite schools, formal and nonformal learning, and educational and community functions,

providing intensive education with integrated family services. It runs four residential schools, four satellite schools, a community medical center, day care center, nursery, maternal care program, and outreach programs, all contributing to the education of children once unreachable. The education program teaches English, Khmer, mathematics, science, the arts, and digital literacy skills. The pedagogical approach aims to develop independent and critical thinking, the acquisition of a worldview, and awareness of individual responsibility.[228]

It is notable that these examples are often located in disadvantaged, underserved communities. It might be tempting to suggest that communities with fragile social capital do not offer a promising foundation for the school to flourish as a core social center. That is, when community institutions are weak it might be thought that there is too much ground to make up for schools to bring seemingly fragmented groups and services together. And yet, this is precisely the circumstance where this conception of schooling seems best to flourish. In more affluent, less challenging circumstances, the strength of individualism is too strong and the motivation to blur boundaries and work in partnership too often insufficient. Faced by the urgency of genuinely challenging circumstances, the pressure to collaborate to make a real difference becomes stronger and the strength of shared purpose is magnified. Far from being undermined by lack of social capital, schools as core social centers is a promising way to build that capital. This depends on the school being strengthened as a learning environment in this prominent community role, not abandoned by the system.

Platforms as 'Schools within Schools'

Technology-based platforms further illustrate the complexity of 21st century schooling. They may operate as "schools within schools," possibly with more than one such platform integrated into the complex infrastructure of teaching and learning within the same school.

Globaloria, invented by the U.S.-based World Wide Workshop in 2006, is a K-12 learning platform with courses for teaching kids how to design and code educational games, using industry tools and professional practices. It has a customized learning platform, a learning management system, live and virtual support for users, and blended professional development for educators.[229] The **Song Room**, an Australian nonprofit, provides courses in music, drama, dance, and the visual and media arts. Its national online interactive arts learning platform (ARTS: LIVE) facilitates collaboration among teachers, teaching artists, and students and offers more than 400 curriculum-aligned, media-rich digital resources. It has shown positive results on attainment and engagement, especially among disadvantaged indigenous students.[230]

The complexity becomes still more apparent when the platforms get students and teachers working together not only across sites and schools within the same system, but from different countries around the world. There is nothing new about international exchanges, of course, but what has changed significantly now with digital media is that this can be done synchronously (or with the short time zone delays) and in ways that benefit teaching and learning. For instance, the **Connecting Classrooms** initiative has created a web platform for connecting and engaging students from around the world in East Asia and the Pacific, North America, Europe, and Sub-Saharan Africa in cross-cultural discussions, illustrating the multiliteracies approach (Section 2), as well as engaging in projects and problem-solving. It enables students in developing and industrialized countries to collaborate around topics of shared concern such as health and climate change. Both students and teachers use the online platform designed for group interaction and collaborative work.[231]

Unlike traditional international student exchanges, the initiative is offered at no cost to students. Programs offering cultural exchanges via online collaboration also

improve student confidence in their ability to communicate with peers around the world. These exchanges are effective in bridging cultural divides, and teachers also benefit by being exposed to different teaching methods and realities.[232]

Scaffolding for Complexity

The Catalog cases give examples of scaffolding complex learning environments through particular model approaches, adopting routines and structured relationships that reinforce a particular ethos. They offer "glue" to hold the organization together in the face of complexity—the school acquires identity and the necessary professional learning may be simplified. The "responsive classroom" model adopted in the **E. L. Haynes Public Charter School** in the United States takes a social justice approach; it gives all in the school a shared vocabulary and structures interactions by students throughout the school day.[233] **Cunningham Elementary School** in the United States chose the microsociety framework, in which students create their own campus society, including businesses, government, and other public services.[234] **Kyrene de los Cerritos** primary school in the United States has adopted the Leader in Me, a whole-school transformation model that acts "like the operating system of a computer that improves performance of all other programs."[235] The Leader in Me is credited with producing improving academic achievement and discipline and increasing engagement by teachers and parents. Critical Feminist Pedagogy is the model approach at **Prerna Girls School** in India, with a curriculum that uses multimodal tools such as critical dialogues, drama, digital stories, and music.[236]

These models already serve to scaffold educational and professional relationships. The scaffolding is still more complete when the theoretical model is backed by materials. In resource-poor environments, already devised packages and repositories of materials may be particularly valuable. The **Lively Minds** program

in Ghana and Uganda is a behavioral change program which provides a two-year support package to help build capacity and train kindergarten teachers and volunteer mothers to lead play-based learning schemes for young children where there is lack of provision and limited home stimulation.[237] The curriculum for the **Akanksha** After-School Centers and School Project in India is accompanied by customized teaching and learning tools, including worksheets and quizzes to supplement textbooks. The manuals for teachers include modules on building self-esteem, with projects on self-development, family, community, the nation, and the world.[238]

There may be innovation in the formats for communicating the materials to schools and communities as well as in the approaches they espouse. Both types of innovation—the what and the how—characterize the **Life Lab** toolkits and training from India. These allow low-income schools to promote activity-based learning, encouraging questions, conjecture, and observation and engagement in self-directed learning. Life Lab has used WhatsApp to connect teachers to other toolkit-users.[239] Another example is **Camara—Transforming Education Kenya**. This is a social enterprise that uses technology to deliver 21st century skills to disadvantaged communities in Kenya; its eLearning packages include hardware, software/educational packages, teacher training, and technical support.[240]

Certain innovative sites embed the gamification pedagogy (see Section 2) within their own package of approaches, tools and materials. These include:

• **Clic Educa: Clases Interactivas**, a cloud-based Chilean software offering teachers a suite of learning tools: a communication platform, an evaluation platform, digital lesson planning, online modules and curricula, and teacher training. The interactive and mostly gamified materials can be projected on screens in classrooms or used in computer labs/individual tablets.[241]

- The **iCivics** initiative, a free U.S. site that includes print-and-go lesson plans, interactive digital tools, and role-playing games. The game-centered, standards-aligned curriculum provides middle and high school students with the tools for active participation and democratic action. The games place students in different civic roles and give them agency to address real-world problems and issues. They are rooted in clear learning objectives and integrated with lesson plans and other curricular materials and allow teachers to create class discussions using its online form.[242]

These examples serve as a reminder that, to be successful as scaffolding, adult learning (school leaders, teachers, and other educators) must be ensured to have a beneficial impact on student learning. Pedagogy is just as important for adult learning as it is for children.

The prominence of adult (teacher) learning is especially clear in the **Col.legi Montserrat** example, a Spanish educational reform movement that starts by changing how teachers see their roles, provides them the tools to play their new roles and creates the support system for the changes. Once the mindset has changed, Montserrat offers schools and teachers a set of tools to help transform the curriculum, the teaching and evaluation methodologies, classroom and school organization, as well as teachers' and students' roles. All emphasize critical thinking skills, project-based learning and integrating service learning and social entrepreneurship in the curriculum. Col.legi Montserrat has also launched an online television channel as a platform for training, "Think One TV."[243]

Relying on each network, program and movement to market itself can mean that schools, communities, educators and parents are vulnerable to sales pitches by persuasive gurus, corporations and educational salespeople. A useful resource for schools, educators, communities and parents would be an up-to-date,

disinterested repository of "anchor" models. This could include indication of suitable contexts and supporting materials, together with substantiation for any claims made about effectiveness. This is a variant of the Idea Hubs proposal in the earlier CUE "Millions Learning" report: "Leaders in governments, in partnership with civil society and the private sector, should establish Idea Hubs for identifying, adapting, and sharing effective approaches to improving learning and scaling them."[244] It encompasses both knowledge sharing and consumer protection.

We promoted in this section the need to address the enabling conditions to promote powerful and innovative pedagogies. We focused in particular on professional capacity and teacher learning, both to ensure the foundations of quality teaching and to build on that with the professionalism to apply innovative pedagogies. We argued the value of widening the profile of educators as integral to many of the pedagogies and repertoires required for leapfrogging transformation. We recognized the complexity of education provision and the need to address hybrid programs and arrangements explicitly, including the importance of community and technology in contemporary learning environments. And with such complexity and the demanding nature of professionalism we argued for scaffolding, through educational models and support materials. An essential part of this scaffolding is provided by networks and associations—the theme of the next section.
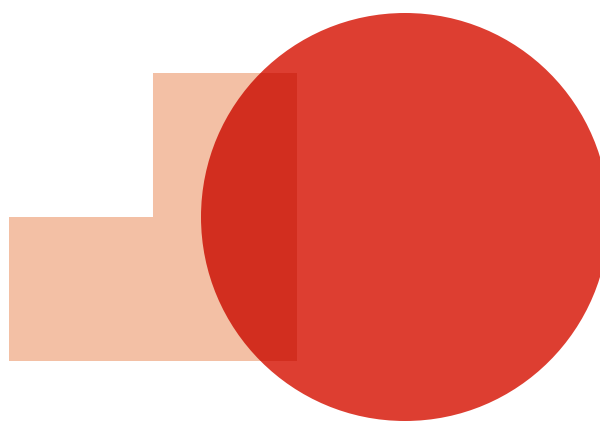
Scaling Deep Change is Required to Transform Teaching and Learning

Nothing short of system transformation is the full impli-cation of envisioning an education system where the innovative pedagogies we discussed are flourishing. Taking the innovative pedagogies seriously implies shifting models for teacher development, workforce, and schools, and pursuing pathways for expanding this change broadly. For leapfrogging approaches to make a difference beyond individual schools and communities, innovation of teaching and learning must happen at a significant scale. There are many isolated brilliant practices and charismatic teachers around the world and, of course, each innovation and each excel-lent educator makes their own important difference in the lives of students whom they affect. But unless new approaches and dynamics grow, they remain idiosyn-cratic and personal.

Scaling up depends partly on growing core edu-cation provision, funding, and political will. But with innovations, the transformations also must come from the ground to take root and grow, and it is this form of scaling that we discuss in this section. Several substantive studies have been conducted in the last decade on scaling education innovation, and together they provide a valuable package of insights from the ground on how to expand improvements in learning. This includes CUE's "Millions Learning" report, which conceptualizes scaling as a range of pathways that expand and deepen effective approaches and lead to lasting improvements in people's lives. The report

focuses on the principles of design, delivery, finance, and enabling environment that allow education ap-proaches to take root and spread, and also empha-sizes the importance of local context and education champions.[245] The 2016 "Journeys to Scale" report by Results for Development Institute and UNICEF emphasizes the importance of context, and factors such as active community engagement; ownership and empowerment; human capacity; the reputation of partners; and designing, planning, and continued experimentation.[246]

Here we focus on a particular theme—scaling as deep change. We first discuss the meaning and scope of scaling educational innovations, including the nature of the students' learning experiences. We then turn to examples of innovative approaches that are already multisite, i.e., school networks and chains of schools. Networks represent the broader concept and may be partial to a particular topic or group of teachers; a "chain" formalizes the bonding of whole schools into groups and are often referred to as "networks"— including through franchising—around a particular philosophy and organization. Together with different communities of practice, these are developments in what OECD defines as the "meso" layer of education systems, which lies between the micro level of stu-dents, teachers, and schools, and the macro level of policy and resources. This middle layer is a critical arena for innovations in pedagogies, teaching, and

learning, alongside structural changes in delivery of education and education infrastructure, on the one hand, and successful teacher learning, on the other.

Scaling Innovative Pedagogies Requires a Focus on Deep Change

Scaling itself must be addressed, if the intention is to grow and sustain the innovative pedagogies previously discussed. There might be the temptation to equate scaling with simple notions of expanding participants or recipients, an equation that is increasingly understood as simplistic.[247] Cynthia Coburn addressed this limited quantitative understanding of scaling in a seminal article, to propose that the concepts and frameworks of scaling are much more powerful when they address deep change. This is not a technical academic question, because it addresses a profound difference in how scaled change and transformation occur: "How education researchers and reformers define scale matters, for it influences both the ways reformers and policymakers craft reform strategies, and the ways researchers study the problem of scale."[248] As we are deeply interested both in how reform strategies are crafted, and also in teaching, learning, and pedagogy, the issue of how scaling is conceptualized and addressed is highly pertinent to our exploration of leapfrogging.

Scaling as Deep Change

Coburn's concept of deep change "goes beyond surface structures or procedures (such as changes in materials or classroom organization, or the addition of specific activities) to alter teachers' beliefs, norms of social interaction, and pedagogical principles as enacted in the curriculum."[249] Coburn expands the analytical understanding of scale by delineating four interrelated dimensions that go well beyond the definition of scaling in the purely quantitative sense of participant numbers:

- **Depth** refers to deep and consequential change in classroom practice, altering teachers' beliefs, norms of social interaction, and pedagogical principles as enacted in the curriculum.
- **Sustainability** means that change has to be more than fleeting; an innovation is scaling if "its use can be sustained in original and even subsequent schools."
- **Spread** is based on the traditional meaning of scaling as diffusion of the innovation to growing numbers of classrooms and schools, but it also means to "spread reform-related norms and pedagogical principles *within* a classroom, school, and district."
- **Shift** requires districts, schools, and teachers, as well as community partners, to assume ownership of an innovation so that it becomes internalized, rather than externally imposed and run.[250]

These four dimensions are closely related: the spread of a practice within a school or district could also be considered as deepening, and shift of ownership could be interpreted as a precondition of sustainability. Taken together, the dimensions describe how leapfrogging can happen: deep change at a scale that is no longer dependent on the original champions, but that is adopted by many and sustained by those responsible for enacting the change. That is, leapfrogging calls for the expansion of innovations in this deep sense: the sustained deep change of multiple innovations that create movement and system "shift"—the "sea change" that we referred to in Section 1.

To these dimensions, Dede has added a fifth, **evolution**, in which the "innovation as revised by its adapters is influential in reshaping the thinking of its designers, creating a community of practice that evolves the innovation."[251] This too is significant, because it means that while the objectives and principles of the innovation may be the same as the original inspiring innovation, the form it takes can evolve with observation and practice. In complex ecosystems, evolution is a natural feature of scaling. However, this characteristic of scaled innovation is problematic both when attempting

to define the innovation for purposes of evaluation, and also for the concept of fidelity to original designs. Scaling deep change is illustrated in figure 4.1 below.

Scaling Deep Change

Depth   Sustainability   Spread   Shift   Evolution
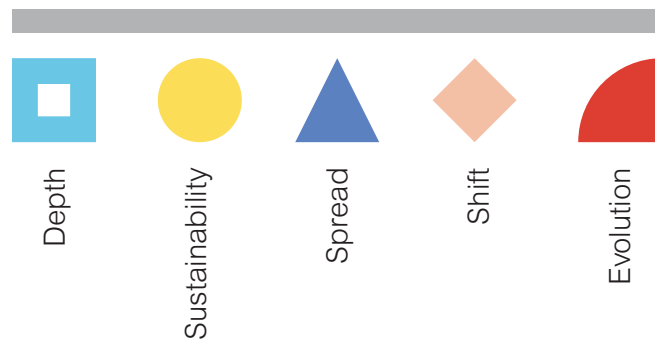
Scaling as Learners' Exposure to Breadth of Skills

We can extend the depth that is so critical to Coburn's definition to learners. In addition to a program and its features, the object of scaling can shift to what it entails, at any one time and over time, for the overall menu of learning experienced by children and young adults. We can ask how much learners enjoy breadth of skills experiences, expressed both in numbers of learners (spread) and in terms of their overall learning up to age 18 (depth). The meaning of scale thus becomes the extent of learners' exposure to opportunities that broaden and deepen their skills during a particular time period (such as the duration of an innovative program they participate in) and during their initial educational careers.

The hybridization of learning environments and the diversification of delivery of education, especially during

> The meaning of scale thus becomes the extent of learners' exposure to opportunities that broaden and deepen their skills during a particular time period.

the teenage years, makes assessment of scale in this sense particularly relevant, but also more problematic than understanding it primarily as how to grow particular innovative programs. Emphasizing breadth of skills shifts the focus away from characteristics of programs, and toward the impact as experienced by the participants of the programs as they are integrated into the mainstream schooling they already receive. Though the measurement challenges of these questions are legion, this represents a potentially critical as well as exciting field of research.

Education Networks Have the Power to Scale Deep Change

The collaborative work of communities of practice and networking is an essential aspect of embedding deep change. Transforming mindsets, norms, and approaches for deep change requires sustained engagement, dialogue, and support. Hence, education networks are important for scaling this type of transformation. We here use the concept of "education networks" very broadly, to embrace many different constellations of interconnection, with different structural and organizational features. For example, education networks include the learning and synergies created by professional educators working together, networked chains of schools or programs, and the different community and family connections within flourishing educational ecosystems. Scaling deep change can be supported through the rise of individual networks, the consistency with which those networks together promote particular trends in pedagogy and teaching, and the density of networking itself, i.e. the extent of networking as a feature of an education system.

When schools and educators are working multisite, there is already growth and scaling, as well as examples of the increasing complexity of systems and governance. When an innovation is implemented on a larger scale, this enables the development of supportive materials, courses, and infrastructure and an

Figure 4.2

The Meso Layer of Education

> **Macro Layer**
> Policy and Resourcing
>
> **Meso Layer**
> Education Networks
>
> **Micro Layer**
> Students, Teachers
> and Schools
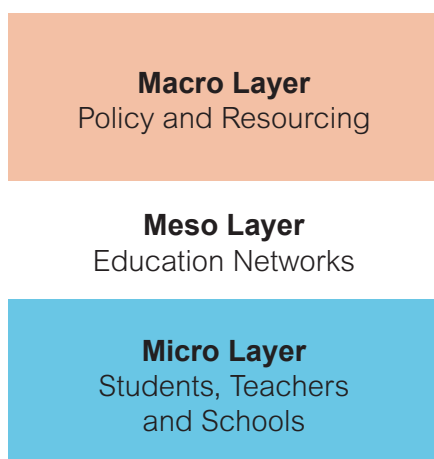
established community of practice around a shared approach. A "chain" is more formal and enjoys the visibility that comes with a multisite presence and reputation, even though it is constrained to pursue particular methods and practices.

Successful leveraging of education networks for scaling deep change illustrates the complexity of education, challenging simple notions of the system as necessarily bounded by national or district boundaries. In fact, the networks are often themselves hybrids, by belonging both to a national or district system, and also to a global chain. Education networks exist in the meso layer of an education system (see figure 4.2).[252]

We found several examples of these education networks in our review of innovations, and here share a selection of them, to illustrate the different ways in which networks are advancing transformative change.

Chains for the Underserved

The chains and networks of schools explicitly aimed at the underserved and society's disadvantaged are

represented in our Catalog. For example, **Parikrma Humanity Foundation** runs a small chain of schools in Bangalore, India, that use end-to-end assistance to support students from severely underprivileged backgrounds. Without this help, the students likely would not attend school. The chain provides high quality K-12 education supplemented by health care, family support services, scholarships for higher education, and career mentorship. Parikrma schools have a strong academic curriculum that emphasizes English language proficiency and cocurricular activities, such as sports, music, and art.[253]

Other examples include **YouthBuild Charter School** of California, a competency-based dropout recovery chain for students aged 16-24 from low-income families and underserved communities;[254] **Sparrow Schools** is a South African chain aimed at students aged 7-18 with learning difficulties, who receive an individualized approach to help them return to local mainstream schools.[255]

Escolas Bradesco in Brazil represents a bridge between programs for the most disadvantaged and affordable fee-paying networks (examined next in this section).[256] The program consists of 40 free private schools that are run by Bradesco Bank's charity arm and serve the country's under-resourced and hardest-to-reach youth, at pre-kindergarten through post-secondary levels. Its approach embraces both traditional academic subjects and a focus on entrepreneurship and civics, including open science and art labs, health clinics, sports in partnership with local communities, environmental projects, and digital inclusion labs. An online portal connects students, teachers, and parents, and teachers use the portal for discussion and development between themselves. There are online and blended courses for all students above the early-childhood level, and distance courses for young people and adults who have not finished their studies. The program has apprenticeship ties with Bradesco banks, as well as special courses for the visually

impaired. One issue is that the program depends on philanthropic financial support, which raises the question of its sustainability. Escolas Bradesco also provides pedagogical resources and training to local teachers in the public system outside its network. Another example of a chain of no-fee independent schools targeting students in high-need communities is the **LEAP South African Science and Maths Schools**, which offer high quality education along with academic and life skills, aimed at developing future leaders for the country.[257]

The poor quality of teaching and learning in many corners of the world, rich and poor, is the brute fact that introduced this report. In many areas, the quality of teaching in the public schools, and in many of the neighbouring private ones, remains stubbornly low. In these circumstances, chains of low-fee schools with rigorous but innovative approaches may prove to be valuable supplements to the core public education, as well as important catalysts for change beyond their actual numbers. **Future Nation Schools** in South Africa aim to innovate with a model that is futuristic and technology-enabled, and that embodies excellence. The ambition is to build a network of affordable private schools across South Africa and the rest of the continent.[258] **Innova Schools** is a Peruvian chain of low-fee schools based on blended learning approaches. Students spend 70 percent of the day in a traditional classroom and the other 30 percent in a computer lab, working individually on their own learning plan at their own pace. The schools follow a socio-constructivist pedagogy and prioritize collaborative, hands-on learning.[259]

These examples can target the middle class, which, even if it is relatively small in some contexts, is a key segment of the population to bring on board for innovative learning approaches to be scaled throughout an education ecosystem. However, encouraging these types of schools has complex policy implications. One issue is the extent to which the private schools add to opportunities for and stimulate positive change in surrounding public schools, or whether they instead draw capacity and energy away from the mainstream system and thereby diminish it. Another difficulty is how to enlist public authorities to support private schools and—when they rely on wealthy philanthropic support—whether they are replicable.

Design-Based High School Chains

McDonald highlights the significance of networks of schools based on explicit innovative designs as adding a new dimension of connection and influence to the traditional formal system. Just as important, these schools create new spaces for innovation in the design of learning and the organization of education. This layering of connection, design, and organization on top of the formal system illustrates the complexity of current systems and is a key aspect of scaling and leapfrogging. McDonald elaborates:

> [The] change involves the development and proliferation of design-based networks of schools, both charter and not, operating within and sometimes across communities—for example, Urban Assembly schools in New York, High Tech High schools in San Diego, Green Dot schools and Aspire schools in Los Angeles, and KIPP schools, Expeditionary Learning schools, and Big Picture schools in many places. These networks challenge the traditional conception of the school district as the key shaper of a school's mission, culture, instructional design, and curriculum. Some of these school design networks also challenge what was once a sharp distinction between in-school and out-of-school, by means of their use of community settings and online formats for teaching and learning.[260]

Some of the best known chains of innovative schools are featured in our Catalog on innovations. For instance, **High Tech High**, founded in San Diego, United States, is a group of charter schools that also includes locations in Canada, Israel, and Singapore, and a graduate teaching institution.[261] Teaching is based on

personalization and connection with the world, and a common interest in learning, with teachers as learning designers and monitors. Teachers guide students through project-based learning, with content organized in themes that students tackle to resolve specific problems, based on each student's situation and interests. **Expeditionary Learning** (now **EL**) is a chain of schools that began in the United States and expanded elsewhere.[262] The chain emphasizes real-world and project-based learning, with rigorous academic standards and evaluations that aim for depth and high quality outcomes. EL values deep learning and mastery, and the production of high quality tangible outcomes.

These networks of schools also were highlighted in American Institute of Research studies about deeper learning, and with positive results.[263] The studies found that, on average, students who attended the schools in the study achieved higher scores on all three PISA subjects (reading, mathematics, and science), as well as on state English language arts and mathematics tests. Also, students who attended participating network schools reported higher levels of collaboration skills, academic engagement, motivation to learn, and self-efficacy. Study findings showed no significant differences with students from nonnetwork schools on reported creative thinking skills, perseverance, locus of control, or self-management. Finally, students who attended participating network schools were more likely to graduate from high school on time, and although they had similar rates of enrollment in postsecondary institutions, they were more likely to enroll in four-year and selective institutions. There are further criteria that would be worthwhile to follow up longitudinally, including whether these networks of schools instill engagement, learning skills, or curiosity that might continue into lifetimes of learning.

These examples and evaluations of design-based chains of schools reinforce the messages of Section 2 about the value of identifying and preparing explicitly

for particular, often innovative, pedagogies, and the discussion in Section 3 about the value of scaffolding. We are not arguing that these types of schools can be implemented in any context, because their effectiveness will depend on many factors, including suitable teacher capacity to work with the challenges of the designs in question. Nor are we arguing that these types of schools are always positive. Either the designs themselves can be flawed, or the capacity and organization can be inadequate, or the conditions in which they are trying to take root are not conducive. They are not panaceas or magic bullets. But chains of innovative schools are features of the meso level that is growing in importance, as discussed in conclusion of this section.

Global Chains of Innovative Schools

The chains can themselves be cross-national. For instance, the **Common Ground Collaborative** is a global, nonprofit network of educators, schools, and social entrepreneurs, with its own curriculum and a commitment to building learning capacity in ways that are simple, smart, and sustainable.[264] The **Colegio Mundo Unido** in Costa Rica is part of the **United World Colleges** network, which offers pre-university residential experiential learning.[265] The **Financially Self-sufficient Schools**, organized with lead partner Fundacion Paraguaya, is an international network of secondary schools (in Afghanistan, Bolivia, Colombia, Ecuador, El Salvador, Guinea, Haiti, Malawi, Paraguay, South Africa, Tanzania, and Uganda).[266] The network offers low-income students in middle- and low-income countries a quality education, with real microenterprises on campus underpinning the teaching of practical agricultural and business skills.

The Meso Level is Critical for Leapfrogging

In conclusion, we return to the importance of the meso layer—the different collaborations and combinations

that are between the levels of individual schools and entire formal systems. This middle layer takes many forms, including the more formal education networks and chains of schools. Meso does not mean a middle tier of administration (of the school district or board), though these levels of administration may contribute to the meso mosaic. It refers to the groupings of schools—formal, nonformal, hybrid; stable, dynamic, unstable; public, private, or mixed—most of which never appear in official diagrams of any system.

As proposed in the 2015 OECD report "Schooling Redesigned," "The creation of flourishing sets of meso networked learning ecosystems is a principal means through which the broader meta transformation can take place."[267] An important route to leapfrogging will come through the density and dynamism of the meso layer. Density and direction are portrayed in figure 4.3. Within scaling up of innovative teaching practices, there will be countless connections constantly being made and unmade, innovations taking root and dying away all the time. Furthermore, scaling does not mean a practice will grow indefinitely.

Figure 4.3

Three Dimensions of Scaling Up Meso-Level Network Innovation

Individual Network Growth

Increasing Network Density

Greater Alignment of Network Trends
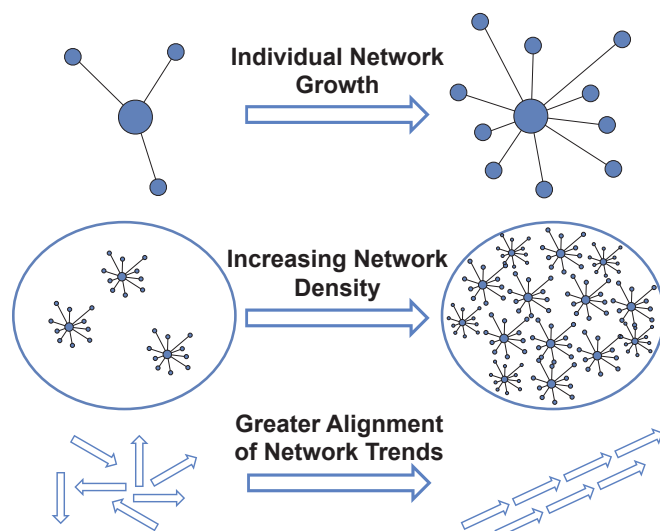
Understanding the education system as primarily the hierarchically organized and official system of formal schooling is too limiting to address many of the innovations and practices discussed in this report. Extending the meaning of the system to that of a broader ecosystem does not reduce the importance of the crucial formal delivery of education. Rather, the formal education system is embedded within the myriad connections, communities, networks, and programs that make up the meso layer, which together constitutes the overall ecosystem. This shift to a broader education ecosystem puts the onus on education innovators, professionals, and communities to do the scaling. Much of the teacher learning and development will take place through networking and communities of practice, and this may be relatively cost effective. The most effective role of government frequently will be to create the conditions in which the networking, collaborations, programs, and partnerships can flourish.

However, there is a fine line between governments encouraging—and even funding—chains of innovative schools, and reshaping governance and accountability through grouping schools as part of restructuring the formal system.[268] If the formal system brings schools together as part of its overall management and structures, or organizes reforms through official networks, there is a risk of losing the dynamism of voluntary activity by professionals. At the same time, local networking of schools and educators will often need the injection of external expertise or will need to operate within larger frameworks and partnerships, if educator knowledge on the ground is to flourish.

Small-scale networked activity among like-minded educators can be just as significant to larger macro change as reforms that affect hundreds of schools. They activate different energies and motivations and engage different stakeholders and contribute to larger shifts which, if the many small-scale networked innovations are broadly aligned, can become significant movements. On this, Peurach et al. suggest that to

achieve network alignment, the networks should have the means to incorporate the lessons and practices learned by its members.[269]

Therefore, scale means much more than counting participants, and more is not always better than less in education. Combinations of relatively small-scale networks can also help address the concern that innovation might become diluted if it is expanded too much. Law, Kampylis, and Punie found that in the case of technology-enhanced learning innovations, "innovations implemented at larger scale tend to have less ambitious educational goals as a common strategic basis for participation, requiring lower levels of innovativeness in the pedagogical practices."[270] If expansion of an innovation is instead bounded within many different networks of schools, it may be possible to avoid the dilution of innovation and the trade-off between scale and innovation. This also relates to the characteristic of scaling as evolution, in which models and practices often will need to be adapted, both to maintain their effectiveness and to work in different contexts. But these issues require far more sustained research and knowledge development, including the extent to which these patterns are specific, either to the technology-enhanced nature of the innovations, or the particular countries in which they were identified.

We argue that there are at least five important actions that education decision-makers, especially governments, should take to leverage the power of networking for scaling deep change:

1. **Go beyond simplistic quantitative models of scaling up**. Meaningful scaling means deep change in behaviors, collaborations, and cultures. It means addressing depth, sustainability, spread, and shift in ownership. It also means allowing the adaptation of innovation into new forms that depart from the original inspiration.
2. **Foster the conditions for networking and a dynamic meso layer**. This means working positively with different types of networks and partnerships, in a spirit of collaboration rather than of competition or mistrust. It means resisting the temptation to formalize horizontal collaboration by bringing it into the vertical hierarchical system. A challenge for policy is to balance the vertical and horizontal, providing leadership in some areas while allowing professional or community leadership in others.
3. **Ensure that governance and accountability regimes do not stymie networking**. Much of the innovative space in contemporary education ecosystems lies outside the neat boundaries of official diagrams. Therefore, the innovation often will fly below policy radars, and even be actively discouraged by governments. Accountability rules should recognize the value of the collaboration inherent in education networks, and avoid an exclusive focus on individual units like schools, principals, and teachers.
4. **Assume leadership over the dimensions of scaling that are beyond the reach of innovative networks**. This means that governments should focus on the aspects that they are often best positioned to supply: ensuring the right to a quality education for each young person is met, political support, stable funding, evidence of impact, and supporting professional knowledge building. Governments should also work with teachers and their representative bodies to develop stable systemwide conditions and environments within which diverse meso-level change can occur.
5. **Sponsor targeted research and promote system research and development**. Governments also are in a strategic position to increase knowledge that will contribute to transforming learning and ultimately, leapfrogging. They can help establish knowledge banks and should sponsor evaluative research. Some of this research should be directed to better understanding the nature of the meso layer, and the optimal conditions for meso-level collaborations to flourish.

Conclusion

This report expresses twin priorities that we sought to address. The first priority is that learning is critical and is at the heart of the ambition to leapfrog education systems, and this in turn entails addressing the core of teaching and pedagogy in our education systems. This is especially the learning of children and adolescents but also teacher learning. The second priority is that there is a need to learn from the experiences of existing transformative approaches to clarify how innovative, powerful forms of learning can be spread and sustained, especially under challenging circumstances. Leapfrogging inequality calls for very explicit priority to be given to learners from the least advantaged backgrounds and those whose achievements are lowest, because they are on the front line of the learning crisis that is now receiving global recognition. Growing learning inequalities worldwide underscore the scale of this task—to first stop and then reverse the tide—and this calls for transformation of the education system.

The need to leapfrog to greater heights toward lifelong learning requires innovation in both teaching and education systems, with an explicit focus on pedagogy. The international community has been far more able to recognize the need for pedagogical change than to address what the needed pedagogical approaches actually are. Our report has laid out the foundations of these pedagogical choices and their key enablers. We focused both on the professional capacity of teachers and their own learning, as well as on widening the profile of educators as integral to pedagogical and system transformation. In the 21st century, we operate in complexity, both of ecosystems and of multi-layered hybrid forms of delivering education. Such complexity,

and the demanding nature of professionalism, call for the scaffolding of coherent educational models and complementary support materials. Transformation demands scaling as deep change in cultures of collaboration. We argued the pivotal role of the meso level—of networks, programs, and communities of practice—to make this happen.

Ultimately, we call on all of those engaged in delivering education services to young people—government decision-makers, educators, civil society leaders, funders, and the private sector—to embrace innovative pedagogy; to put in place the enabling environment strategies of basic quality teaching, a widened educator profile, and hybrid learning environments; and finally, to promote education networks as one way to expand deep change. These are important and difficult things to do, but well worth it, if we are serious about leapfrogging to a new place where all children and young people can become lifelong learners.
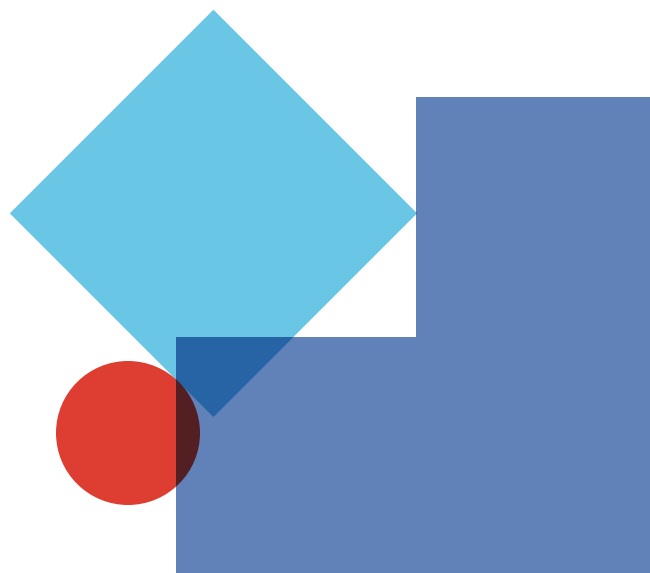
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Section 7

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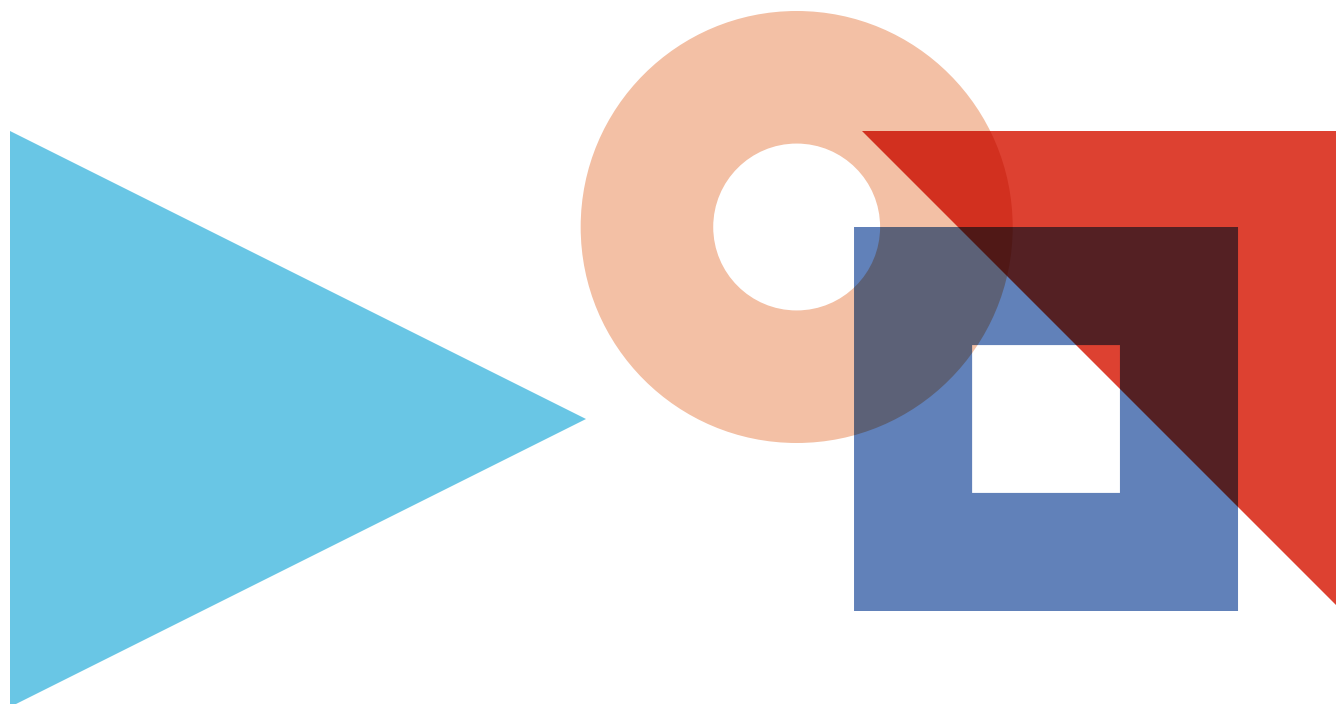
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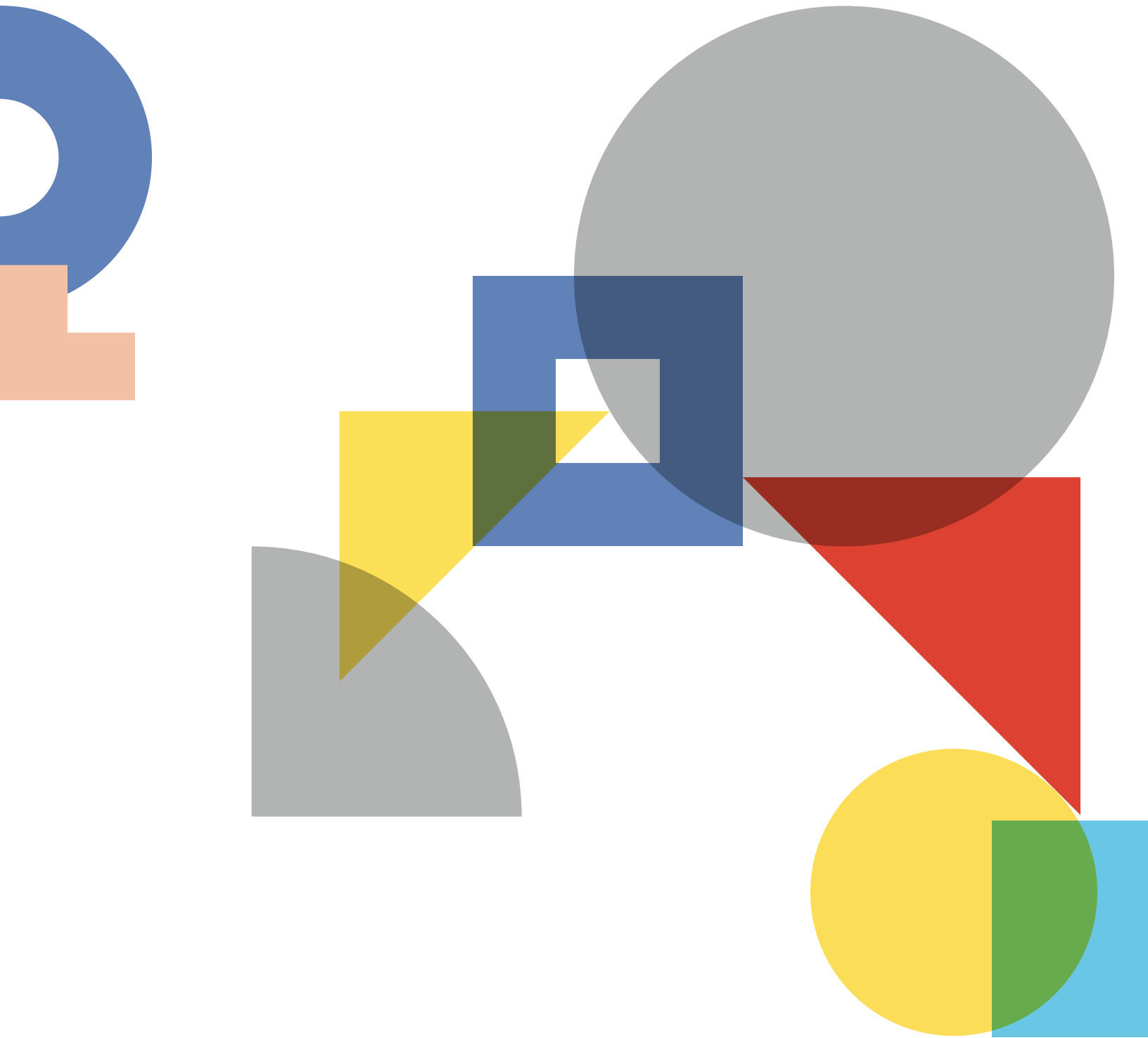
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